STATE OF CALIFORNIA
DEPARTMENT OF NATURAL RESOURCES
FRED G. STEVENOT, Director

DIVISION OF MINES
FERRY BUILDING, SAN FRANCISCO

WALTER W. BRADLEY State Mineralogist

San Francisco] BULLETIN No. 103 [September, 1930

CALIFORNIA MINERAL PRODUCTION FOR 1929

By
HENRY H. SYMONS

CONTENTS

LETTER OF TRANSMITTAL

September, 1930.

To His Excellency, THE HONORABLE C. C. YOUNG,
Governor of the State of California.

SIR: I have the honor to herewith transmit Bulletin No. 103 of the State Division of Mines, being the annual report of the statistics of the mineral production of California.

The remarkable variety, total valuation, and wide distribution of many of our minerals revealed herein show California's importance as a producer of commercial minerals among the states of the Union.

Respectfully submitted.

WALTER W. BRADLEY,
State Mineralogist.

INTRODUCTION

It is the endeavor of the staff of the State Division of Mines (formerly State Mining Bureau), in these annual reports of the mineral industries of California, to so compile the statistics of production that they will be of actual use to producers and to those interested in the utilization of the mineral products of our state, while at the same time keeping the individual's data confidential. In addition to the mere figures of output, we have included descriptions of the uses and characteristics of many of the materials, as well as a brief mention of their occurrences.

The compilation of accurate and dependable figures is an extremely difficult undertaking, and the State Mineralogist takes the opportunity of here expressing his appreciation of the cooperation of the producers in making this work possible. A fuller appreciation of the value of early responses to the requests sent out in January will result in earlier completion of the manuscript. Statistics lose much of their value if their publication is unnecessarily delayed.

Some of the data relative to properties and uses of many of the minerals herein described are repeated from preceding reports, as it is intended that this annual statistical bulletin shall be somewhat of a compendium of information on California's commercial minerals and their utilization.

WALTER W. BRADLEY,
State Mineralogist.

MINERAL INDUSTRY, CALIFORNIA, 1929

DATA COMPILED FROM DIRECT RETURNS FROM PRODUCERS IN ANSWER TO INQUIRIES SENT OUT BY THE CALIFORNIA STATE DIVISION OF MINES, FERRY BUILDING, SAN FRANCISCO, CALIFORNIA

CHAPTER ONE

The total value of the mineral output of California for the year 1929 was $432,248,228, being an increase of $99,533,995 over the 1928 total of $332,714,233. There were fifty-four different mineral substances, exclusive of a segregation of the various stones grouped under gems; and all but one of the fifty-eight counties of the state contributed to the list.

As revealed by the data following, the salient features of 1929 compared with the preceding year were: A large increase in the amount and total value of the petroleum output; also material advances were shown by natural gas, copper, mineral water, diatomaceous earth, granite, quicksilver, salt and soda. Decreases were registered by cement, borax, pottery clay, gold, lead, magnesite and silver. Petroleum showed an increase in value of $91,368,183. There was an increase from 231,811,465 barrels to 292,534,221 barrels, this being the largest annual production of crude oil in the history of the state. The building of pipe lines increased the demand for natural gas and the output increased from 260,887,116 M cu. ft. worth $22,260,947 to $400,192,201 M cu. ft. worth $29,067,546.

Of the metals copper increased from 25,162,304 lb. worth $3,623,360 to 33,809,258 lb. worth $5,941,799 and quicksilver from 7,107 flasks worth $844,649 to 10,152 flasks worth $1,195,705; while gold output decreased in value from $10,785,315 to $8,526,703, lead decreased from 1,882,795 lb. worth $109,102 to 1,428,777 lb. worth $90,014 and silver from 1,478,771 fine oz. worth $865,081 to 1,176,895 oz. worth $627,285. The increase in copper was due to higher prices for that metal over the preceding year, but this did not hold true with lead, silver and zinc, as their prices were higher but not enough to justify the reopening of mines shut down in 1928.

Of the structural materials, granite increased from a total value of $763,996 to $1,169,271 and miscellaneous stone from $17,332,110 to $17,840,159, while cement decreased from 13,625,231 bbls. worth $24,463,287 to 12,794,729 bbls. worth $21,038,565, and this group, as a whole, was the only one to show a decrease. The Industrial group in general showed increases with mineral water leading the list, with an increase from 25,049,002 gals. worth $1,304,969 to 27,032,083 gals. and $2,040,615. Of the Saline group, salt increased from 340,480 tons

worth $1,024,656 to 392,039 tons worth $2,665,436 and soda from 80,838 tons worth $1,469,297 to 90,646 tons worth $1,838,657, while borates decreased in value from $3,378,552 to $3,312,085, but showed an increased quantity from 109,722 tons to 144,678 tons.

The figures of the State Division of Mines are made up from reports received direct from the producers of the various minerals. Care is exercised in avoiding duplication, and any error is likely to be on the side of under- rather than over-estimation.

California yields, commercially, a greater number and variety of mineral products than any state in the United States, and probably more than any other equal area elsewhere on the earth. The total annual value of her output has been surpassed by not more than four or five others, and those usually the great coal states of east of the Mississippi. More recently California has been placed second to Pennsylvania, the leader. California was for many years the sole domestic source of borax, chromite and magnesite, and in which we still lead. We lead all other states in the production of gold, quicksilver, and platinum; and have alternated in the lead with Colorado in tungsten, and with Oklahoma in petroleum.

The mineral industries, not only in California but throughout the country, have reached quite a different phase from that of the old gold-rush days more than fifty years ago. A broader and more intimate status has been attained, touching practically every avenue of domestic and commercial endeavor. As quoted in a former report[1] of the freight handled by the railroads of the country, the products of the mines represent 51.33 per cent. While gold, in which California still leads the United States, is still important, other metals and even non-metals have superseded it in annual value. The greatest commercial developments proportionately in California in recent years have taken place among the industrial and structural minerals, not to mention petroleum, which leads all others in value. This introduces a new factor which requires study and attention—that of marketing. The gold miner could, and still does, take his metal to the mint and receive its equivalent in the 'coin of the realm'; and he knows from day to day and year to year, without variation, just how much each ounce of gold will bring in that coin, though its equivalent in other commodities varies according to economic conditions. Marketing and competition, however, are vital factors in the industrial and structural groups.

[1] Cal. State Min. Bur., Bulletin 96, p. 12, 1925.

By Substances.

The following table shows the comparative yield of mineral substances of California for 1928 and 1929, as compiled from the returns received at the State Division of Mines, San Francisco, in answer to inquiry sent to producers:

Substance	1928		1929		Increase+ Decrease— Value
	Amount	Value	Amount	Value	
Antimony	20 tons	$761			$761—
Barytes	13,406 tons	55,888	26,796 tons	168,329	112,941+
Bituminous rock	4,966 tons	33,832	3,320 tons	14,360	19,472—
Borates	109,722 tons	3,378,552	144,678 tons	3,312,085	66,467—
Brick and hollow building tile		5,694,770		5,607,410	87,360—
Cement	13,625,231 bbls.	24,463,287	12,794,729 bbls.	21,038,565	3,424,722—
Chromite	729 tons	15,179	327 tons	5,025	10,154—
Clay (pottery)	887,807 tons	1,394,950	839,949 tons	1,127,517	267,433—
Coal	582 tons	3,442	450 tons	2,476	966—
Copper	25,162,304 lbs.	3,623,360	33,809,258 lbs.	5,941,799	2,318,439+
Dolomite	38,379 tons	85,342	58,644 tons	156,928	71,586+
Feldspar	14,628 tons	93,745	13,377 tons	78,404	15,341—
Fuller's earth	53,323 tons	501,743	15,541 tons	170,563	331,180—
Gems		22,200		26,850	4,650+
Gold		10,785,315		8,526,703	2,258,612—
Granite		763,996		1,169,271	405,275+
Gypsum	104,790 tons	200,567	104,844 tons	396,951	196,384+
Lead	1,882,795 lbs.	109,102	1,428,777 lbs.	90,014	19,088—
Lime	56,616 tons	547,919	42,834 tons	417,101	130,818—
Limestone	127,895 tons	397,935	162,315 tons	557,617	159,682+
Magnesite	45,645 tons	501,590	47,769 tons	488,014	13,576—
Marble[a]	34,324 cu. ft.	82,190		93,661	11,471+
Mineral paint	*	*	467 tons	2,820	*—
Mineral water	25,049,002 gals.	1,304,969	27,032,083 gals.	2,040,615	735,646+
Natural gas	260,887,116 M.cu.ft.	22,260,947	400,129,201 M.cu.ft.	29,067,546	6,806,599+
Petroleum	231,811,465 bbls.	229,998,680	292,534,221 bbls.	321,366,863	91,368,183+
Platinum	312 fine oz.	27,902	212 fine oz.	14,416	13,486—
Pumice and volcanic ash	10,440 tons	105,055	10,449 tons	76,123	28,932—
Pyrite	90,566 tons	400,627	79,169 tons	363,717	36,910—
Quicksilver	7,107 flasks	844,649	10,152 flasks	1,195,705	351,056+
Salt	340,480 tons	1,024,656	392,039 tons	2,665,436	1,640,780+
Sandstone	134,100 cu. ft.	43,250	177,655 cu. ft.	49,881	6,631+
Silica (sand and quartz)	14,814 tons	66,679	18,686 tons	79,210	12,531+
Silver	1,478,771 fine oz.	865,081	1,176,895 fine oz.	627,285	237,796—
Slate		31,263		*	*+
Soapstone and talc	18,668 tons	251,372	18,676 tons	193,493	57,879—
Soda	80,838 tons	1,469,297	90,646 tons	1,838,657	369,360+
Stone, miscellaneous[b]		17,332,110		17,840,159	508,049+
Tungsten	*	*	150 tons	106,480	*—
Unapportioned		[c]3,932,031		[d]5,329,679	1,397,648+
Total value		$332,714,233		$432,248,228	
Net increase					$99,533,995

* Included under Unapportioned.

[a] Includes onyx and travertine.

[b] Includes macadam, ballast, rubble, riprap, sand, gravel.

[c] Includes asbestos, bromine, calcium chloride, diatomaceous earth, lithia, magnesium salts, manganese, mineral paint, potash, sillimanite-andalusite-cyanite group, tin, titanium, tungsten.

[d] Includes asbestos, bromine, calcium chloride, diatomaceous earth, magnesium salts, manganese, mica (sericite), potash, slate, sillimanite-andalusite-cyanite group, tube-mill pebbles, sulphur,

By Counties.

The following table shows the comparative value of the mineral production of the various counties in the state for the years 1928 and 1929:

County	1928	1929
Alameda	$2,421,830	$3,626,723
Alpine	8,529	33,013
Amador	2,644,179	2,498,217
Butte	640,272	584,319
Calaveras	2,802,542	2,522,259
Colusa	36,500	42,570
Contra Costa	2,100,482	1,827,956
Del Norte	381,358	84,263
El Dorado	329,427	367,500
Fresno	4,227,286	2,413,495
Glenn	101,889	81,516
Humboldt	300,227	293,678
Imperial	241,678	509,832
Inyo	1,832,567	2,296,210
Kern	43,064,781	38,809,239
Kings	577,819	4,259,833
Lake	189,103	387,700
Lassen	76,499	88,698
Los Angeles	144,835,988	243,568,275
Madera	514,495	1,027,410
Marin	449,568	470,002
Mariposa	282,201	244,017
Mendocino	40,490	59,000
Merced	653,187	1,110,498
Modoc	30,440	30,996
Mono	214,420	212,831
Monterey	351,660	354,858
Napa	306,262	649,822
Nevada	2,023,886	1,980,028
Orange	39,655,177	28,491,495
Placer	333,135	266,347
Plumas	3,599,127	5,137,968
Riverside	6,274,901	5,401,860
Sacramento	2,389,645	2,247,302
San Benito	1,654,718	1,908,462
San Bernardino	14,157,381	11,210,652
San Diego	1,770,253	1,447,287
San Francisco	67,430	75,245
San Joaquin	624,931	789,891
San Luis Obispo	217,125	191,084
San Mateo	3,328,573	3,672,779
Santa Barbara	4,577,650	16,407,136
Santa Clara	1,021,541	963,478
Santa Cruz	3,323,920	3,327,633
Shasta	1,114,729	1,751,196
Sierra	679,925	390,402
Siskiyou	471,166	229,789
Solano	45,551	66,421
Sonoma	224,468	351,383
Stanislaus	472,158	388,235
Sutter	2,000	
Tehama	14,389	14,480
Trinity	530,180	525,874
Tulare	445,366	296,881
Tuolumne	376,278	371,520
Ventura	31,116,675	34,043,899
Yolo	17,200	14,400
Yuba	2,529,076	1,820,371
Totals	$332,714,233	$432,248,228

Total Mineral Production of California, by Years, Since 1887.

The following tabulation gives the total value of mineral production of California by years since 1887, in which year compilation of such data by the State Mining Bureau (now Division of Mines) began. At the side of these figures have been placed the values of the most important metal and non-metal items—gold and petroleum.

In the same period copper made an important growth beginning with 1897 following the entry of the Shasta County mines, and more recently Plumas County. Cement increased rapidly from 1902, while crushed

rock, sand and gravel as a group parallels the cement increase. Quicksilver has been up and down. Mineral water and salt have always been important items, but the values fluctuate. Borax has increased materially since 1896. War-time increases, 1915–1918, were shown by chromite, copper, lead, magnesite, manganese, silver, tungsten and zinc. Most of these have since declined, though silver, structural materials and copper increased in 1920–1924, also lead and magnesite in 1923; lead and zinc in 1925; zinc in 1926, with silver declining; an increase in quicksilver in 1927–1928, with declines in other metals and by petroleum. Natural gas has shown a steady increase since 1907, and in 1929 its value was second only to petroleum.

Total Mineral Production of California, by Years, Since 1887

Year	Total value of all minerals	Gold, value	Petroleum, value
1887	$19,785,868	$13,588,614	$1,357,144
1888	19,469,320	12,750,000	1,380,666
1889	16,681,731	11,212,913	368,048
1890	18,039,666	12,309,793	384,200
1891	18,872,413	12,728,869	401,264
1892	18,300,168	12,571,900	561,333
1893	18,811,261	12,422,811	608,092
1894	20,203,294	13,923,281	1,064.521
1895	22,844,663	15,334,317	1,000,235
1896	24,291,398	17,181,562	1,180,793
1897	25,142,441	15,871,401	1,918,269
1898	27,289,079	15,906,478	2,376,420
1899	29,313,460	15,336,031	2,660,793
1900	32,622,945	15,863,355	4,152,928
1901	34,355,981	16,989,044	2,961,102
1902	35,069,105	16,910,320	4,692,189
1903	37,759,040	16,471,264	7,313,271
1904	43,778,348	19,109,600	8,317,809
1905	43,069,227	19,137,043	9,007,820
1906	46,776,085	18,732,452	9,238,020
1907	55,697,949	16,727,928	16,783,943
1908	66,363,198	18,761,559	26,566,181
1909	82,972,209	20,237,870	32,398,187
1910	88,419,079	19,715,440	37,683,542
1911	87,497,879	19,738,908	40,552,088
1912	88,972,385	19,713,478	41,868,344
1913	98,644,639	20,406,958	48,578,014
1914	93,314,773	20,653,496	47,487,109
1915	96,663,369	22,442,296	43,503,837
1916	127,901,610	21,410,741	57,421,334
1917	161,202,962	20,087,504	86,976,209
1918	199,753,837	16,529,162	127,459,221
1919	195,830,002	16,695,955	142,610,563
1920	242,099,667	14,311,043	178,394,937
1921	268,157,472	15,704,822	203,138,225
1922	245,183,826	14,670,346	173,381,265
1923	344,024,678	13,379,013	242,731,309
1924	374,620,789	13,150,175	274,652,874
1925	434,519,660	13,065,330	330,609,829
1926	450,330,856	11,923,481	345,546,677
1927	366,781,394	11,671,018	260,735,498
1928	332,224,233	10,785,315	229,998,680
1929	432,248,228	8,526,703	321,366,863
Totals	$5,486,500,187	$684,718,589	$3,371,395,646

CHAPTER TWO

FUELS

Among the most important mineral products of California are its fuels. This subdivision includes coal, natural gas, and petroleum, the combined values of which made up practically 81 per cent of the state's entire mineral output for the year 1929.

There are deposits of peat known in several localities in California, small amounts of which are used as a fertilizer, and in stock-food preparations, but none has yet been recorded as utilized for fuel.

Comparison of values during 1928 and 1929 is shown in the following table:

Substance	1928		1929		Increase+ Decrease— Value
	Amount	Value	Amount	Value	
Coal	582 tons	$3,442	450 tons	$2,476	$966—
Natural gas	260,887,116 M.cu.ft.	22,260,947	400,129,201 M.cu.ft.	29,067,546	6,806,599+
Petroleum	231,811,465 bbls.	229,998,680	292,534,221 bbls.	321,366,863	91,368,183+
Total value		$252,263,069		$350,436,885	
Net increase					$98,173,816

COAL

Bibliography: State Mineralogist Reports VII, XII–XV (inc.), XVII, XIX–XXI (inc.). U. S. Geol. Surv., Bulletins 285, 316, 431, 471, 581; Ann. Rept. 22, Pt. III.

The coal produced in California in 1929 totaled 450 short tons valued at $2,476 being credited to Amador and Trinity counties with a single operator in each. The 1929 output was a decrease from that of 1928 which was 582 short tons worth $3,442. This coal was consumed by the local market and also used on the property for camp purposes, power and forge, to carry on regular operations and development work.

Total Coal Production of California.

The very considerable output of coal in the years previous to 1883 was almost entirely from the Mount Diablo district, Contra Costa County. Later the Tesla mine in Corral Hollow, Alameda County, was an important producer for a few years. Stone Canyon, Monterey County, was also an important producer for a short time, and there has been some coal shipped from properties in Amador, Fresno, Orange, Riverside and Siskiyou counties. The following tabulation gives the annual tonnages and values, according to available records:

Coal Output and Value, by Years

Year	Tons	Value	Year	Tons	Value
1861	6,620	$38,065	1897	87,449	$196,255
1862	23,400	134,550	1898	143,045	337,475
1863	43,200	248,400	1899	160,941	420,109
1864	50,700	291,525	1900	176,956	535,531
1865	60,530	348,048	1901	150,724	401,772
1866	84,020	483,115	1902	88,460	248,622
1867	124,690	716,968	1903	93,026	265,383
1868	143,676	826,137	1904	79,062	376,494
1869	157,234	904,096	1905	46,500	144,500
1870	141,890	815,868	1906	24,850	61,600
1871	152,493	876,835	1907	23,734	55,849
1872	190,859	1,097,439	1908	18,496	55,503
1873	186,611	1,073,013	1909	49,389	216,913
1874	215,352	1,238,274	1910	11,033	23,484
1875	166,638	958,169	1911	11,047	18,297
1876	128,049	736,282	1912	14,484	39,092
1877	107,789	619,787	1913	25,198	85,809
1878	134,237	771,863	1914	11,859	28,806
1879	147,879	850,304	1915	10,299	26,662
1880	236,950	1,362,463	1916	4,037	7,030
1881	140,000	805,000	1917	3,527	7,691
1882	112,592	647,404	1918	6,343	16,149
1883	76,162	380,810	1919	2,983	8,203
1884	77,485	309,950	1920	2,078	5,450
1885	71,615	286,460	1921	12,467	63,578
1886	100,000	300,000	1922	27,020	135,100
1887	50,000	150,000	1923	1,010	5,090
1888	95,000	380,000	1924	1,425	8,800
1889	121,280	288,232	1925	730	3,880
1890	110,711	283,019	1926	1,100	5,000
1891	93,301	204,902	1927	200	1,100
1892	85,178	209,711	1928	782	4,542
1893	72,603	167,555	1929	450	2,476
1894	59,887	139,862			
1895	79,858	193,790	Totals	5,209,842	$23,111,476
1896	70,649	161,335			

The tonnages in the above table for the years 1861–1886 (incl.) are taken from the U. S. Geological Survey, "Mineral Resources of the U. S., 1910," p. 107. The values assigned for the years previous to 1883 are those given by W. A. Goodyear (Mineral Res., 1882, pp. 93–94), being an average of $5.75 per ton. From 1887 to date the figures are those of the California State Mining Bureau.

NATURAL GAS

Bibliography: State Mineralogist Reports VII, X, XII, XIII, XIV, Bulletins 3, 16, 19, 69, 73, 89. Monthly Summary, Oil & Gas Supervisor, Dec., 1919; Aug., 1922; Mar., 1923; Mar. and Apr., 1926.

Statistics on the production of natural gas in California are in a considerable degree difficult to arrive at, as much of it that is utilized directly at the wells for heating, lighting, and driving gas engines is not measured. Hence, it is necessary to approximate the output of many of the operators in the oil fields, estimated on the number of lights, and on the number and horsepower of gas engines and steam boilers thus operated. The figures here given are for gas utilized locally and also that sold for distribution to consumers; and we consider are not overestimated, particularly in the six oil-producing counties. It must be remembered that some of our important oil fields are removed many miles from the site of any other industry, and that the gathering of small amounts of gas and transporting it for any considerable distance

Aeroplane view of North Dome, Kettleman Hills Oil Field, Kings County, strikingly showing the geologic structure.
Photo by courtesy of Continental Air Map Company.

may not always be profitable, nor is it often possible to have pipe-line facilities available to handle the gas accompanying the early gas production in newly developed fields. Wherever feasible, casing-head gas is used in driving gas engines for pumping and drilling, and in firing the boilers of steam-driven plants.

The most notable gas developments in California have been in the Elk Hills and Buena Vista Hills in Kern County, northeast of the Midway district; in the oil fields in the Los Angeles basin, Los Angeles and Orange counties; in Ventura County; and during 1928 the bringing in of the Kettleman Hills field in Kings County.

The use of natural gas will be furthered in the industry of the state; first, by the construction of pipe lines to all of the principal cities in the state, and, second, by a law passed by the last legislature making the unreasonable waste of natural gas illegal. Heretofore all gas that could not be sold or used on the property was wasted, but now it has to be used or the well is closed in until such a time when it can be used.

Natural Gas Pipe Lines.

During the past twelve years more than 5000 miles of natural gas pipe lines have been laid in California. With the laying of the pipe lines the amount of natural gas used increased as well as the uses to which it was put. At the present time, the value of this material is second only to petroleum. Natural gas is also being compressed into containers of various sizes and shipped in this form to places where it is not practical to build pipe lines.

The compressed gas in small containers makes it possible for people living in isolated places to have gas for cooking, heating, and lighting. There is a project now under way to compress the natural gas into specially built tank cars, ship it to Oregon and Washington and there distribute it to the gas mains of the various towns. This system will give service to California cities not accessible to pipe lines.

The year 1929 saw the completion of the natural gas pipe line of the Pacific Gas and Electric Company, from Buttonwillow and Kettleman Hills to the cities of the San Francisco Bay area and the people of that region receiving natural gas for domestic and industrial uses. During the year work on construction of a pipe line up the San Joaquin Valley to give service to the cities of that valley also to extend through to the cities of the east and north sides of San Francisco Bay, with a branch going to Sacramento and another pipe line going from Kettleman Hills to Fresno, also a branch line from the now completed line to San Francisco area to the towns of the Monterey peninsula, are now under way. There is a line to be built from the Los Angeles and Orange county oil fields to San Diego. On page 20 of Bulletin 102 a map was printed showing the major natural gas pipe lines that were completed in September, 1929, and those proposed for construction.

Production and Value.

There is rather a wide variation in prices quoted for natural gas because a considerable part is used directly in the field for driving gas engines and firing boilers, and is therefore not measured nor sold. Such companies as have placed a valuation on the gas that was thus used in 1929 gave from 3¢ to 29¢ per 1000 cu. ft. at the well. From

the totals shown in the tabulation following herein, the average value for all fields in 1929 works out at approximately 7.25¢ M cu. ft. Approximately 7000 cu. ft. of gas is equal to one barrel of oil in heating value, and is so accounted for by many operators. In driving gas engines, about 4000 cu. ft. per 24 hr. are consumed by a 25-h.p. engine, and 63,700 cu. ft. per day for heating a 70-h.p. steam boiler, which figures have been utilized in compiling this report, in those cases where gas was not metered.

Natural Gas 'Consumed,' or Utilized for Fuel, 1929

County	*M cu. ft.*	*Value*
Fresno	1,006,110	$190,598
Kern	34,409,095	1,861,950
Kings	25,809,765	965,165
Los Angeles	228,708,726	17,410,493
Orange	31,318,309	2,602,382
Santa Barbara	1,291,786	145,680
Ventura	77,293,145	5,812,729
Butte, Humboldt, Lake, Mendocino, Sacramento, San Joaquin, San Mateo and Santa Clara*	292,265	78,549
Totals	400,129,204	$29,675,546

* Combined to conceal output of a single operator in each.

The above total for 1929 was the largest annual production of natural gas in California and shows a marked increase over the 1928 figures which were 260,887,116 M cu. ft. and $22,260,947. An important increase in the quantity utilized in 1929 was made by Los Angeles County which shows 228,708,726 M cu. ft. worth $17,410,493 compared with 110,432,906 M cu. ft. worth $9,058,485 in 1928. There were also increases made by Kings, Santa Barbara and Ventura counties in the amount of gas utilized, but the last two mentioned above showed decreases in total value. Fresno County showed a decreased quantity with a slightly increased value while Kern and Orange counties showed decreases in both quantity and value.

Natural Gas Production in California, Since 1888.

The production of natural gas in California by years since 1888 is given in the following table. The first economic use of natural gas in California was from the famous Court House well at Stockton, bored in 1854–1858. Beginning about 1883 and for several succeeding years, a number of gas wells were brought in around Stockton. Natural gas was known in a number of other localities, and occasionally utilized in a small way, notably at Kelseyville in Lake County, and in Humboldt County near Petrolia and Eureka, but there are no available authentic records of amounts or values previous to the year 1888. The most important developments in the commercial production of natural gas have been coincident with developments in the oil fields, by utilizing the casing-head gas as well as that from dry-gas wells.

Natural Gas Production in California Since 1888

Year	M cubic feet	Value	Year	M cubic feet	Value
1888	[a]12,000	$10,000	1910	10,579,933	$1,676,367
1889	[a]14,500	12,680	1911	[a]5,000,000	491,859
1890	[a]41,250	33,000	1912	[a]12,600,000	940,076
1891	[a]39,000	30,000	1913	14,210,836	1,053,292
1892	[a]75,000	55,000	1914	16,529,963	1,049,470
1893	[a]84,000	68,500	1915	21,992,892	1,706,480
1894	[a][b]85,080	79,072	1916	28,134,365	2,871,751
1895	[a][b]110,800	112,000	1917	44,343,020	2,964,922
1896	[a][b]131,100	111,457	1918	46,373,052	3,289,524
1897	[a]71,300	62,657	1919	52,173,503	4,041,217
1898	[a]111,165	74,424	1920	58,567,772	3,898,286
1899	115,110	95,000	1921	67,043,797	4,704,678
1900	40,566	34,578	1922	103,628,027	6,990,030
1901	120,800	92,034	1923	240,405,397	15,661,433
1902	120,968	99,443	1924	209,021,596	15,153,140
1903	120,134	75,237	1925	194,719,924	15,890 082
1904	144,437	91,035	1926	214,549,477	19,465,347
1905	148,345	102,479	1927	224,686,940	20,447,294
1906	168,175	109,489	1928	260,887,116	22,260,947
1907	169,991	114,759	1929	400,129,201	29,067,546
1908	842,883	474,584			
1909	1,148,467	616,932	Totals	2,230,391,882	$176,178.096

[a] Quantity, in part, estimated, where values only were reported.
[b] Includes natural CO_2 from a mine in Santa Clara County.

Gasoline from Natural Gas

More or less gas usually accompanies the petroleum in the oil fields, and such gas carries varying amounts of gasoline. A total of 145 plants were in operation in 1929 recovering gasoline by compression or absorption from this 'casing-head' gas. After the gasoline is extracted the remaining 'dry gas' so far as practicable is taken into pipe lines, by which it is distributed to consumers, both domestic and commercial.

In certain of the oil fields, some of the casing-head gasoline is obtained as an incidental product to the compressing of the natural gas preliminary to its transmission to consuming centers through the gas pipe lines. Some concerns market the casing-head gasoline separately, others blend it with distillery gasoline, while others turn it into the oil pipe lines thus mixing this high-gravity gasoline with the crude oil for transportation to the refinery where it is later regained.

A total of 804,158,700 gallons of casing-head gasoline valued at $55,168,970 was reported as made from all fields by 145 plants during 1929, compared with 546,941,272 gallons valued at $39,191,165 from 141 plants in 1928. It was distributed as follows:

Natural-Gas Gasoline Recovered, 1929

County	*No. plants*	*Gallons*	*Value*
Kern	24	66,363,659	$5,640,911
Kings	3	48,440,201	2,024,800
Los Angeles	81	510,034,972	22,043,839
Orange	15	71,965,383	5,843,589
Santa Barbara	3	9,870,916	771,906
Ventura	19	97,434,994	7,629,160
Other	---	48,575	4,324
Totals	145	804,158,700	$55,168,970

The usual recoveries of gasoline from natural gas vary from ½ gal. to 3 gal. per 1000 cu. ft. of gas handled, the average being about 1 gal. per 1000 cu. ft. The U. S. Bureau of Mines report by Knudsen[1] gives

[1] Knudsen, E. T., Statistical Summary of California Petroleum Industry, 1929; U. S. Bureau of Mines, 1930, p. 56.

the average recovery for 1929 as 1.391 gallons per 1000 cu. ft. of gas treated. His figures show the following production, by methods:

Natural-Gas Gasoline Production, 1929, by Methods

(Per U. S. Bureau of Mines)

Method	*Gallons*	*Recovery (Gal. per M cu. ft.)*
Oil absorption	566,374,303	1,367
Compression	3,246,045	1,110
Combination compression and oil absorption	234,368,630	1,451
Drip	151,248	----
Totals	804,140,226	1,391

PETROLEUM

Bibliography: State Mineralogist Reports IV, VII, X, XII, XIII, Bulletins 3, 11, 16, 19, 31, 32, 63, 69, 73, 82, 84, 89. Reports of Oil and Gas Supervisor 1915 to date (issued in monthly chapters since April, 1919). U. S. Geol. Surv., Bulletins 213, 285, 309, 317, 321, 322, 340, 357, 398, 406, 431, 471, 541, 581, 603, 621, 623, 653, 691; Prof. Papers 116, 117. "American Petroleum; Supply and Demand"; Amer. Petr. Inst., 1925.

The crude petroleum produced in California for 1929 amounted to a total of 292,534,221 barrels of crude oil valued at $321,366,863 at the well; this was the largest annual production in this state although the value of output was greater in both 1925 and 1926.

This total of quantity is compiled from the monthly production reports filed by the operators with the State Oil and Gas Supervisor, to which have been added figures for the output of a number of small operators in the old Los Angeles City Field not under the jurisdiction of the Supervisor.

The question of the value of the crude oil yield at the well is a difficult one to settle with exactitude principally because a large part of the output is not sold until after refining. The large refiners are also large producers of crude oil which they send direct from well to plant, hence much of the crude oil is not sold as such.

The value used in the statistical reports of the State Mining Bureau and the Division of Mines and Mining from 1914 to 1927 (inc.) was derived from an average of actual sales of crude oil of all grades in each field of the state and their average applied to the total yield of each respective field. The 1929 values, used by the Division of Mines, were obtained by using the production of crude oil by gravities produced in each field [1] and applying an average of current prices quoted by the Standard Oil Company for crude oil at the well.

Features of 1929.

The noteworthy features of the year 1929 in the oil industry in California were: the largest annual production of crude oil; increased production in Los Angeles, Santa Barbara, Kings and Ventura counties; the bringing in of the Playa del Rey oil field in Los Angeles County.

Summarizing the data for the year, the State Oil and Gas Supervisor[2] presented the following figures:

PRODUCTION.

"The total production of oil in the state for the last six months of 1929 was 150,073,579 barrels of oil and 63,297,264 barrels of water. The production of oil for the year 1929 was, therefore, 292,409,197 barrels, an increase of 60,759,582 barrels over that of 1928.

[1] By courtesy of Standard Oil Co.

[2] Bush, R. D., Resume of Oil Field Operations of California in 1929, Summary of Operations—California Oil Fields, Vol. 15, No. 3, Jan., Feb., March, 1930.

"The production of oil for the second half of 1929 was 7,737,961 barrels more than for the first half. Water production increased 792,154 barrels during the same period."

* * * * * * *

"The estimated closed-in production was increased during 1929 from 123,113 barrels daily in January to a maximum of 190,985 barrels daily in December."

* * * * * * *

STORAGE AND PRICE CHANGES.

"The total crude and refined petroleum in storage in Pacific Coast territory at the end of 1929 was 184,763,733 barrels, according to the American Petroleum Institute. The increase in storage during the year amounted to 44,762,839 compared with a decrease of 317,723 * barrels during 1928.

"The total amount of crude and refined oil shipped to eastern ports during 1929 was 28,181,000 barrels, or 5,511,000 more than the 1928 shipments. In January in the Los Angeles Basin fields prices of crude oil below 20 degrees gravity were reduced 5 to 15 cents per barrel and in the San Joaquin Valley prices of oil below 24 degrees gravity were were reduced 1 to 25 cents per barrel. In March, crude oil in the Elwood field was reduced 24 cents per barrel. In October, in the Santa Fe Springs, Long Beach, and Seal Beach fields, crude prices were reduced 40 cents to $1.05 per barrel and restored to the former prices in November upon the agreement of the producers to conform to the state-wide curtailment of production.

DRILLING AND DEVELOPMENT.

"During 1929, 1256 wells were reported to the State Oil and Gas Supervisor as ready to drill as compared with 1227 new wells in 1928. The Playa del Rey field was discovered in 1929 near Venice in Los Angeles County. The oil from the discovery well is 24 degrees gravity and is reported to contain considerable sulphur, making it undesirable for refining unless specially treated. Relatively unimportant discoveries of oil were made in the El Capitan and Mesa areas in Santa Barbara County and in the Huasna area in San Luis Obispo County. These developments, as well as the details of operations in the five districts of the state as reported by the deputy supervisors, are given in the following pages."

* Revised figure.

Production Figures.

The following table gives the production and value by counties for 1929 compared with the 1928 figures:

TABLE A

Production and Value of Crude Oil, by Counties

County	*1928*		*1929*	
	Barrels	*Value*	*Barrels*	*Value*
Fresno	4,611,440	$3,524,985	3,498,107	$1,781,586
Kern	44,096,638	36,803,054	43,577,420	32,299,584
Kings	198,784	576,474	1,968,729	3,294,668
Los Angeles	120,549,303	126,709,373	182,444,261	216,871,493
Orange	37,100,943	34,607,932	25,861,815	25,504,922
San Luis Obispo	15,140	12,869	a	a
Santa Barbara	3,078,103	3,409,923	11,141,789	13,984,055
Ventura	22,143,318	24,311,149	24,003,969	27,602,164
Colusa, San Mateo, Santa Clara [a]	17,796	42,921	----------	----------
Colusa, San Luis Obispo, Santa Clara [a]	----------	----------	38,131	28,391
Totals	231,811,465	$225,398,680	292,534,221	$321,366,863

[a] Combined to conceal output of a single operator in each.

The foregoing totals show the average price of $1.094 per barrel for the year 1929 as compared with $0.992 in 1928, $1.127 in 1927 and $1.538 in 1926.

TABLE B

Average Price of Oil Per Barrel, by Counties, 1920–1929

County	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Fresno	$1.293	$1.483	$1.068	$1.710	$1.162	$1.094	$0.815	$0.830	$0.764	$0.519
Kern	1.350	1.714	1.211	.819	1.137	1.432	1.448	1.139	.835	0.741
Kings										1.674
Los Angeles	1.380	1.532	1.403	.971	1.239	1.429	1.645	1.115	1.051	1.189
Orange	1.860	2.138	1.175	.880	1.183	1.417	1.559	1.207	935	0.986
San Luis Obispo	1.040	1.400	.942	.600	.992	1.087				
Santa Barbara	1.125	1.575	1.011	.782	1.036	.914	.793	.750	1.108	1.255
Santa Clara	1.600	1.485	1.616	1.404	1.921	1.634				
Ventura	1.635	2.507	1.785	1.138	1.334	1.710	1.512	1.177	1.098	1.150
State average	$1.409	$1.726	$1.249	$0.923	$1.200	$1.422	$1.538	$1.127	$0.992	$1.094

For several years previous to 1919, the state average value per barrel at the well for crude oil as determined by the statistical returns was noted to practically coincide with the quotations during the same years for 23° gravity oil in the San Joaquin Valley fields. In 1919 and since, the average values have worked out at figures corresponding to quotations up to, in one year as high as 28° oil, due to the large yield of high-gravity oils from the new fields in the Los Angeles-Orange counties area.

TOTAL PETROLEUM PRODUCTION OF CALIFORNIA

The presence of oil seepages and springs in Los Angeles and Ventura counties was known and utilized in a small way early in the history of California. Some also was shipped to refineries at San Francisco from Santa Barbara and Humboldt counties. In the light of present-day developments, the following reference to the previous year's production of oil and its future prospects as expressed by the San Francisco Bulletin of January 8, 1866, is strikingly prophetic even though skeptical:

"It is possible that the small quantity received (40,000 or 50,000 gallons in 1865) may be the forerunner of many millions which will, at some future time, lubricate the wheels of commerce and set a trade at work excelling in variety any that has thus far been known on this coast. At present, however, we admit to being a little skeptical about the assumption of the astute Professor Silliman that California will be found to have more oil in its soil than all the whales in the Pacific Ocean."

According to Hanks,[1] in 1874 production amounted to 36 bbl. per day from natural flows in Pico Cañon (Newhall), and at Sulphur Mountain (Ventura County), the oil being of 32° gravity average.

"Work was commenced in Pico Canyon in 1875 by drilling three shallow wells with spring pole, all of which yielded oil at depths of from 90 to 250 feet. Actual work of development commenced with steam machinery in 1877."[2]

In 1877 Pico averaged 40–50 bbl. daily, and Ventura 80 bbl. daily. In 1878, there was some production (@ 60 bbl. per day, for a time) from wells in Moody Gulch, near Los Gatos, Santa Clara County, the oil being of 46° Baumé.

The first wells in the Coalinga, Fresno County, and Summerland, Santa Barbara County, fields were drilled in 1890, but Coalinga did not make its influence felt conspicuously on the state's annual output until 1903. The Summerland yield never has been large. The Salt Lake field near Los Angeles began production in 1894 and in 1897 reached over a million barrels annually.

In the Kern County fields, the first well was drilled in Sunset in 1891, Midway in 1900, McKittrick in 1892, Kern River in 1899. The Sunset-Midway district attained a yield of over 4,000,000 bbl. in 1909, and over 20,000,000 bbl. in 1910. Kern River field produced over 3,000,000 bbl. in 1901.

The first well in the Santa Maria-Lompoc group, Santa Barbara County, was drilled in 1901, and the district advanced to a yield of over 3,000,000 bbl. annually in 1905.

The Whittier-Fullerton field in Los Angeles and Orange counties became an important factor in 1902. The Montebello field, Los Angeles County, was the conspicuous addition in 1918-1919; and Elk Hills, Kern County, with Huntington Beach and Richfield, Orange County,

[1] Hanks, Henry G., Report IV of State Mineralogist, p. 298, 1884.
[2] *Idem*, p. 301.

in 1920. In 1921, the new fields added were Long Beach and Santa Fe Springs, Los Angeles County; in 1922, Torrance field in Los Angeles County, and Wheeler Ridge field in Kern County; but the production from the large number of new wells started in these new Los Angeles County fields did not reach its peak until August and September, 1923. Dominguez (Compton) came in during 1923; followed by Rosecrans and Inglewood in 1924. Ventura recorded important additions to its producing area in 1925 and 1926. Seal Beach, Orange County, and Mt. Poso, Kern County, were the new fields added in 1926; Round Mountain, Kern County, and Rincon, Ventura County, were the new fields added in 1927; with Potrero in Los Angeles County, Elwood in Santa Barbara County and Kettleman Hills in Kings County in 1928.

During 1929 Playa Del Rey was added to the oil fields in Los Angeles County.

The effect of the advent of these various fields to the producing column will be noted in the tabulation herewith, by years:

TABLE C

Total Petroleum Production in California

Year	Barrels	Value	Year	Barrels	Value
To and inc. 1875	[a] 175,000	[b] $472,500	1904	29,736,003	$8,317,809
1876	12,000	30,000	1905	34,275,701	9,007,820
1877	13,000	29,250	1906	32,624,000	9,238,020
1878	15,227	30,454	1907	40 311,171	16,783,943
1879	19,858	39,716	1908	48,306,910	26,566,181
1880	40,552	60,828	1909	58,191,723	32,398,187
1881	99,862	124,828	1910	77,697,568	37,689,542
1882	128,636	257,272	1911	84,648,157	40,552,088
1883	142,857	285,714	1912	89,689,250	41,868,344
1884	262,000	655,000	1913	98,494,532	48,578,014
1885	325,000	750,750	1914	102,881,907	47,487,109
1886	[a] 377,145	[b] 870,205	1915	91,146,620	43,503,837
1887	678,572	1,357,144	1916	90,262,557	57,421,334
1888	690,333	1,380,666	1917	95,396,309	86,976,209
1889	303,220	368,048	1918	99,731,177	127,459,221
1890	307,360	384,200	1919	101,182,962	142,610,563
1891	323,600	401,264	1920	103,377,361	178,394,937
1892	385,049	561,333	1921	112,599,860	203,138,225
1893	470,179	608,092	1922	138,468,222	173,381,265
1894	783,078	1,064,521	1923	262,875,690	242,731,309
1895	1,245,339	1,000,235	1924	228,933,471	274,652,874
1896	1,257,780	1,180,793	1925	232,492,147	330,609,829
1897	1,911,569	1,918,269	1926	224,673,281	345,546,677
1898	2,249,088	2,376,420	1927	231,195,774	260,735,498
1899	2,677,875	2,660,793	1928	231,811,465	229,998,680
1900	4,329,950	4,152,928	1929	292,534,221	321,366,863
1901	7,710,315	2,961,102			
1902	14,356,910	4,692,189	Totals	3,300,170,232	$3,375,002,163
1903	24,340,839	7,313,271			

[a] U. S. G. S., Min. Res. of U. S., 1886, p. 440, for quantities to and including 1886.
[b] Values have been estimated for the years to and including 1886, after consulting a number of contemporaneous publications, including the Mining & Scientific Press, Reports of the State Mineralogist, and U. S. Reports. The figures for 1887 to date are from records of the State Mining Bureau.

Wildcat Wells.

Wildcat drilling or looking for new oil fields is on the increase although there is less activity in the proved oil fields. The following article by Russel Smith[1] tells some interesting facts on wildcat wells.

[1] Smith, Russel, Oil Bulletin, Vol. XVI, No. 8, pp. 821–823, August, 1930.

"More wildcat wells are now drilling in California than ever before in the history of the state. Although drilling in general, in both proved and wildcat areas, is one-third below the level of the peak reached in 1929, and at virtually the same level as the average of 1925 and 1926, exploration wells have constantly increased in number until there are at the present time about 180 wildcats actively drilling in various parts of the state. These are almost half of the entire number of wells now drilling.

"In spite of overproduction, curtailment, and the generally unsettled condition of the industry, the search for new oil-producing territory is more widespread and intensive than ever before. It is being carried on not only in virgin areas, but within the limits of proved fields by boring far below the levels of present producing horizons. Nor is this condition necessarily to be deplored. Although there is at this time undoubtedly an over-abundance of petroleum available, and although there are known but undeveloped reserves capable of perpetuating this oversupply for an undetermined length of time, it is incumbent upon the oil industry to keep far enough ahead of the demand so that there will not be a shortage of petroleum products, which would be a serious blow to modern industry.

"Furthermore, a complete cessation of drilling activity, even if that were desirable, would be such a paralyzing shock to the oil well supply business that it could hardly be considered.

"None of the wildcat wells now drilling could have an appreciable effect upon the production of the state for from six to twelve months, even should the quest for oil be successful. Very few of these wells, however, can be expected to have any prospects of obtaining commercial production. Past experience has demonstrated that the percentage of failures among wildcat wells is more than 65 to 1; and as the more obvious and more easily located structures are drilled up, this percentage undoubtedly will increase. Drilling in new territory is always precarious business, even if surface structural indications offer fairly good guides. In the case of many of the tests now under way in the state, such surface evidences are lacking.

"From 1914 to 1924, inclusive, 1070 wildcat wells were drilled and fifteen new fields opened. In 1925 and 1926, two fields were opened in drilling 391 wildcat wells. During 1927, a total of 153 wells resulted in the discovery of five new fields. In 1928, four new fields were located by the drilling of 107 wildcats. The official figures for 1929 are not yet available, but it is probable that the total was considerably in excess of that for the preceding year, while only three fields were discovered. One of those was of very minor importance, and another was virtually abandoned within a few months after its discovery.

"In other words, only 29 wildcat wells were successful out of a total of about 1900 drilled in California during the past sixteen years. Many of the others provided information which made possible some of the 29, while the great majority either demonstrated the absence of petroleum in commercial quantities in a particular area, or merely proved individual wells unsuccessful for a variety of reasons. New exploration has been and is being made almost on the sites of some of these earlier wells.

"Wildcats now drilling in California are scattered from Mendocino County to Imperial County, with one reported to be projected for Shasta County, even farther north than Mendocino. Less than half of them are in southern California, and most of the activity is confined to the central part of the state, with the greater portion in the counties of Kern, Santa Barbara, and Ventura.

"Of the entire number only fifteen or twenty are of particular interest, and of these only a half dozen are of outstanding importance and give promise of developing some production.

"About one-sixth of the present drilling wells are being put down by the larger California operators. The rest are being drilled by small companies or individuals, with the exception of a scattered few which are exploratory tests by large companies from the Mid-Continent and the east just making an entry into California. The Shell Oil Company of California has the largest number of active wildcats of any company in the state with a total of ten. The Standard Oil Company is next with six, the Union Oil Company is drilling three, the Ohio Oil Company is drilling three, the Richfield Oil Company is drilling three, the General Petroleum Corporation is drilling two, and the Barnsdall is drilling two, or was until the abandonment of its deep test at Huntington Beach.

"Leading in interest are the wells of Kern County, where there are at least six tests of prominence."

* * * * * * *

"Among the other wildcat tests not specifically mentioned in this brief survey are many which are of some importance, if not for the favorable showings obtained, for the lack of such showings. Among them are many forlorn hopes and some which may surprise by upsetting the dope. It is significant, however, that in this period of over-supply more efforts to develop additional sources of oil are being made than ever in the past. It is almost equally certain to be discovered in California, although it may take many more exploratory holes and perhaps years of time before they are located."

Well Data.

The following table is compiled from the monthly statements issued by the American Petroleum Institute:

TABLE D

Wells Operated by Fields, 1929

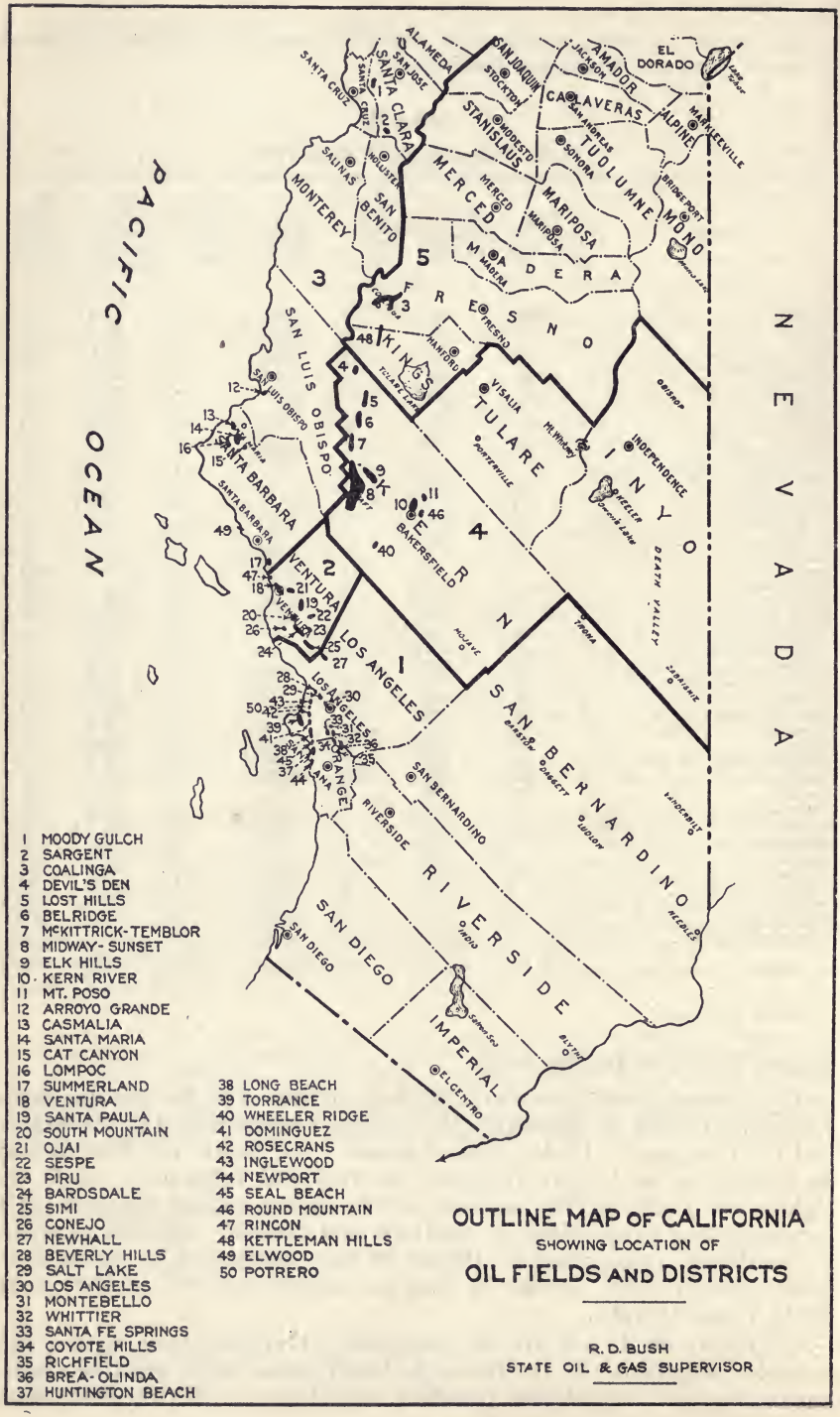
Field	Wells producing Dec. 1928	Wells producing Dec. 1929	Wells completed during year	Daily initial output	Wells abandoned during year	Bbls. per well produced per day Dec. 1928	Bbls. per well produced per day Dec. 1929
Kern River	1,227	963	40	8,390	23	14.6	19.4
Mt. Poso	4	58	61	11,557	9	37.8	196.0
Fruitvale	3	11	16	8,671	2	438.3	278.5
Round Mountain	2	12	13	3,765	2	40.5	210.8
McKittrick	287	282	1	175	2	17.4	17.0
Midway-Sunset	2,462	2,120	86	41,816	66	29.7	34.3
Elk Hills	210	204			5	91.6	81.3
Lost Hills-Belridge	313	322	20	572	5	14.0	14.4
Coalinga	790	755	1	45	11	12.7	12.5
Kettleman Hills	1	2	3	8,015	1	3,756.0	4,689.5
Buttonwillow Gas Field					0		
Wheeler Ridge	34	33			0	24.1	19.4
Watsonville	7	7			0	9.0	9.0
Santa Maria	221	209	2	450	1	22.3	18.0
Summerland	89	96	1	150	3	1.4	4.8
Capitan		1	7	1,085	0		0.0
Elwood-Goleta	7	22	18	67,888	10	1,570.7	1,444.0
Santa Barbara		2	3	1,270	27		69.0
Rincon	25	31	8	1,965	8	163.1	105.0
Ventura Avenue	141	140	51	72,685	0	359.5	363.7
Ventura-Newhall	521	518	7	777	14	10.8	9.5
Los Angeles-Salt Lake	319	311			3	4.5	4.9
Whittier	168	168			1	9.8	9.1
Fullerton (Brea-Olinda)	377	371	4	835	2	38.9	37.9
Coyote	207	208	3	375	2	60.7	53.5
Santa Fe Springs	318	486	276	869,276	29	306.4	344.7
Montebello	167	176	4	415	2	65.9	51.3
Richfield	269	294	25	5,995	16	64.0	50.1
Huntington Beach	554	557	20	2,682	29	89.5	74.6
Long Beach	844	990	192	162,609	40	225.0	106.0
Torrance	604	595			11	25.7	21.2
Dominguez	68	57	1	3,114	0	152.8	183.0
Rosecrans	103	103	6	3,853	22	67.7	69.3
Inglewood	221	228	5	1,735	1	124.0	98.0
Newport	4	3			8	7.5	10.0
Seal Beach	140	161	19	18,879	17	203.2	187.1
Potrero	2	11	10	3,650	6	337.0	68.7
Lawndale	2	7	6	2,552	57	253.0	110.4
Playa del Rey		1	1	2,250			810.0
Miscellaneous drilling					91		
Totals	10,711	10,515	910	1,307,496	526	*65.0	*66.6

*State average.

Specific Gravity of Oils Produced.

The proportion of heavy and light oil produced in the various fields is shown in Table E, following, for which we are indebted to the Standard Oil Company. Under present practice, oil below 18° Baumé may be considered as largely refinable for fuel and lubricants, while the lighter oils yield varying amounts of the higher refined products with corresponding proportions of residuum and fuel oil. Specific gravities in California range from 8° Baumé in the Casmalia field, Santa Barbara County, to 56° Baumé in Ventura County and 60° in Kettleman Hills, Kings County.

California crude oils are all essentially of asphalt base, with a few notable exceptions. In the following localities are wells yielding crudes containing both asphalt and paraffine constituents: Oil City field, Coal-


PACIFIC OCEAN
NEVADA
ALAMEDA
SAN JOAQUIN
AMADOR
EL DORADO
SANTA CRUZ
SANTA CLARA
SAN JOSE
STOCKTON
CALAVERAS
STANISLAUS
MODESTO
ALPINE
MARKLEEVILLE
SALINAS
MONTEREY
SAN BENITO
HOLLISTER
MERCED
TUOLUMNE
SONORA
BRIDGEPORT
MONO
MARIPOSA
MADERA
FRESNO
KINGS
HANFORD
SAN LUIS OBISPO
SANTA BARBARA
VISALIA
TULARE
INDEPENDENCE
INYO
KERN
BAKERSFIELD
VENTURA
LOS ANGELES
SAN BERNARDINO
RIVERSIDE
SAN DIEGO
IMPERIAL
EL CENTRO
DEATH VALLEY
MOJAVE
COLORADO DESERT
1 MOODY GULCH
2 SARGENT
3 COALINGA
4 DEVIL'S DEN
5 LOST HILLS
6 BELRIDGE
7 McKITTRICK-TEMBLOR
8 MIDWAY-SUNSET
9 ELK HILLS
10 KERN RIVER
11 MT. POSO
12 ARROYO GRANDE
13 CASMALIA
14 SANTA MARIA
15 CAT CANYON
16 LOMPOC
17 SUMMERLAND
18 VENTURA
19 SANTA PAULA
20 SOUTH MOUNTAIN
21 OJAI
22 SESPE
23 PIRU
24 BARDSDALE
25 SIMI
26 CONEJO
27 NEWHALL
28 BEVERLY HILLS
29 SALT LAKE
30 LOS ANGELES
31 MONTEBELLO
32 WHITTIER
33 SANTA FE SPRINGS
34 COYOTE HILLS
35 RICHFIELD
36 BREA-OLINDA
37 HUNTINGTON BEACH
38 LONG BEACH
39 TORRANCE
40 WHEELER RIDGE
41 DOMINGUEZ
42 ROSECRANS
43 INGLEWOOD
44 NEWPORT
45 SEAL BEACH
46 ROUND MOUNTAIN
47 RINCON
48 KETTLEMAN HILLS
49 ELWOOD
50 POTRERO
OUTLINE MAP OF CALIFORNIA
SHOWING LOCATION OF
OIL FIELDS AND DISTRICTS
R. D. BUSH
STATE OIL & GAS SUPERVISOR

inga; a few deep wells in East Side field, Coalinga; a considerable part of the Ventura County fields; Western Minerals area, south of Maricopa; Wheeler Ridge, Kern County.

TABLE E

Production of Light and Heavy Oils, by Fields, for 1929

Field	Under 20° (barrels)*	20° above (barrels)*	Total (barrels)*
Kern River	6,089,344		6,089,344
Mt. Poso	1,826,056		1,826,056
Fruitvale	58,843	164,891	223,734
Round Mountain	594,498		594,498
McKittrick	1,708,520		1,708,520
Midway-Sunset	6,785,568	18,525,408	25,310,976
Elk Hills	1,634,003	4,719,032	6,353,035
Lost Hills-Belridge	558,702	1,043,723	1,602,425
Coalinga	3,436,799	122,044	3,558,843
Kettleman Hills	669	1,951,117	1,951,786
Wheeler Ridge		250,156	250,156
Watsonville	22,762		22,762
Santa Maria	973,331	562,484	1,535,815
Capitan		2,795	2,795
Summerland	93,826		93,826
Elwood-Goleta		9,435,819	9,435,819
Santa Barbara	10,863		10,863
Rincon		1,192,237	1,192,237
Ventura Avenue		20,934,388	20,934,388
Ventura-Newhall	17,007	1,839,699	1,856,706
Los Angeles-Salt Lake	552,614		552,614
Whittier	382,182	181,608	563,790
Fullerton	395,930	4,418,012	4,813,942
Coyote	15,965	4,160,070	4,176,035
Santa Fe Springs		76,477,464	76,477,464
Montebello	32,704	3,625,218	3,657,922
Richfield	695,180	5,081,078	5,776,258
Huntington Beach	1,208,932	14,798,098	16,007,030
Long Beach	568,670	59,926,885	60,495,555
Torrance	2,184,246	2,815,972	5,000,218
Dominguez	5,764	3,601,086	3,606,850
Rosecrans	21,456	2,442,352	2,463,808
Inglewood	3,461,817	5,306,284	8,768,101
Newport	15,330		15,330
Seal Beach	23,760	14,394,545	14,418,305
Potrero		271,446	271,446
Lawndale		392,533	392,533
Playa del Rey		25,121	25,121
Totals	33,375,341	258,661,565	292,036,906

* Barrels of 42 gallons.

As previously noted by Bradley,[1] a decided change has taken place in the relative proportions of light and heavy crudes produced in California since 1920, taking 18° Baumé as the dividing line. This subject has also been covered in detail and with charts, by Collom and Barnes.[2]

A marked drop took place in the low-gravity yield from 1910 to and including 1914. From 1914, it remained almost stationary, with a slight drop in 1921, while the high-gravity yield has increased at a rapid rate since 1915. The proportions have been reversed from approximately 75% low—25% high in 1914 to 25% low—75% high in 1921; 10% low—90% high in 1923; 14% low—86% high in 1924–1928.

This has been an important factor in its effect upon the average price per barrel of the state's output in these years, as well as its effect upon the relative situation between production and consumption. It

[1] Bradley, W. W., Mineral Production of California in 1921; Cal. State Min. Bur., Report XVIII, p. 442, Sept., 1922.
[2] Collom, R. E., and Barnes, R. M., California Oil Production and Reserves; Cal. State Min. Bur., Ninth Ann. Rep. of State Oil and Gas Supervisor, Aug., 1923, pp. 5–23.

has been a fortunate development, in view of the increased demand for refinery products (gasoline in particular).

Oil in 'Storage.'

Field, refinery, pipe-line, and tank-farm stocks of crude and refined products in the Pacific Coast territory totaled 184,002,116 barrels [1] December 31, 1929, as compared with 140,000,894 barrels on December 31, 1928. The total increase in stock for the year was 44,001,222 barrels.

	Dec. 31, 1929 (barrels)	*Dec. 31, 1928 (barrels) (revised)*
Heavy crude, heavier than 20° A.P.I., including all grades of fuel	113,421,316	100,249,993
Refinable crude, 20° A.P.I., and lighter	41,469,458	17,954,434
Gasoline	16,432,842	10,766,410
Naphtha distillates	3,327,035	1,541,414
All other stocks	9,351,465	9,488,643
Total all stocks	184,002,116	140,000,894

Utilization of California's Crude Oil.

Most of the crude oil produced in California is sent to storage reservoirs at the tank farms near the oilfields and from these reservoirs by pipe line to the refineries, the larger ones of which are located in the vicinity of Los Angeles or on San Francisco Bay.

During 1929 the crude oil consumed in California, according to the U. S. Bureau of Mines [2] was 243,233,307 barrels sent to the stills at the refineries; 1,289,708 barrels went to intercoastal shipment; 7,643,453 barrels to foreign shipments; and 16,606,731 barrels were either consumed as fuel, added to heavy crude stock or lost.

The production of petroleum products during 1929 is shown in the Table F.

TABLE F

Commodity	*Amount in barrels*
Crude oil	292,036,911
Gas and fuel oils, including heavy crude, below 20° [a]	161,132,577
Natural gasoline	19,146,196
Gasoline and engine distillate	92,964,234
Kerosene	8,425,408
Lubricants	2,389,772
Asphalt	3,771,593
Coke	461,806
All other finished	2,391,393
Total [b]	311,183,107

[a] Includes 16,606,731 barrels of crude oil used as fuel or added to stocks of heavy crude.
[b] Total of crude oil and natural gasoline production.

Operating Data.

The following tabulation (Table G) is compiled from data published by the Department of Petroleum and Gas,[3] semiannually, and here combined to show the entire year's operations for all fields. The districts are the geographical subdivisions as administered by the Department, and which are outlined on the accompanying map.

It will be noted that the state average yield of oil per well per day was 80.8 barrels for the first six months of 1929 and 84.9 barrels for

[1] Standard Oil Bulletin, February, 1930, p. 15.
[2] Knudsen, E. T., Statistical Summary of the California Petroleum Industry, 1928; U. S. Bureau of Mines, 1930, pp. 2, 3.
[3] Summary of Operations, California Oil Fields; Division of Oil and Gas, Fifteenth Annual Report of State Oil and Gas Supervisor, No. 1, July, Aug., Sept., 1929, and No. 3, Jan., Feb., March, 1930.

the second. This is somewhat higher than the figure of 66.7 barrels average for December derived from American Petroleum Institute data as shown in Table D, on a previous page, due in part at least, to the fact that the latter is on a full-time basis, whereas the Bureau figures allow for shut-down time.

TABLE G. Production Statistics and Operating Data of California Oil Fields—1929

Field	January 1 to June 30						July 1 to December 31					
	Average number of producing wells—actual	Oil (bbls.)	Number of days producing	Production per well per day (bbls.)		Percentage of time wells produced	Average number of producing wells—actual	Oil (bbls.)	Number of days producing	Production per well per day (bbls.)		Percentage of time wells produced
				Oil	Water					Oil	Water	
Dist. 1—Beverly Hills	13	66,778	2,089	32.0	25.4	88.8	14	72,475	2,314	31.3	25.7	89.8
Brea-Olinda	380	2,391,638	64,784	36.9	15.3	94.2	382	2,422,542	67,529	35.9	14.2	96.1
Coyote Hills	199	2,109,839	35,020	60.2	38.9	97.2	196	2,022,616	34,998	57.8	37.2	97.0
Dominguez	74	1,884,787	12,773	147.6	57.7	95.4	60	1,701,409	10,516	161.8	68.1	95.3
Huntington Beach	562	8,185,438	94,235	86.9	46.6	92.6	562	7,763,085	97,681	79.5	47.3	94.5
Inglewood	234	4,518,244	40,696	111.0	42.9	96.1	236	4,272,569	42,213	101.2	39.9	97.2
[b]Lawndale	3	196,797	479	410.8	18.1	88.2	6	193,140	1,106	174.6	21.4	100.0
Long Beach	895	33,020,847	152,496	216.5	70.4	94.1	918	27,847,759	152,544	182.6	65.6	90.3
Montebello	203	1,917,030	34,803	55.1	75.5	94.7	198	1,718,075	35,185	48.8	80.9	96.6
Newhall	75	30,877	13,155	2.3	3.9	96.9	64	31,065	11,383	2.7	2.5	96.7
Newport	6	9,355	959	9.7	2.3	88.3	4	6,654	630	10.6	0.7	85.6
[b]Playa del Rey							1	25,121	13	1,932.4	0.0	7.1
Potrero	3	119,045	491	242.5	91.8	90.4	6	141,162	853	165.5	48.8	77.3
Richfield	279	2,999,249	48,613	61.7	9.7	96.3	287	2,765,579	50,563	54.7	9.4	95.7
Rosecrans	103	1,178,615	17,552	67.1	60.1	94.1	100	1,259,057	17,778	70.8	60.0	96.6
Salt Lake	78	153,574	13,467	11.4	18.9	95.4	77	144,154	13,404	10.8	17.2	94.6
Santa Fe Springs	378	33,048,873	58,490	565.0	106.0	85.5	448	43,970,430	68,309	643.7	98.2	82.9
Seal Beach	140	7,330,059	23,300	314.6	134.5	91.9	145	7,110,857	25,863	274.9	119.2	96.9
Torrance	619	2,561,261	103,848	24.7	4.2	92.7	601	2,428,642	104,810	23.2	4.0	94.8
Whittier	175	279,718	30,549	9.2	27.5	96.4	173	282,661	31,549	9.0	27.9	99.1
Totals	4,419	102,002,024	747,799	136.4	47.0	93.5	4,478	106,179,052	769,241	138.0	45.7	93.4
Dist. 2—Bardsdale	118	125,417	19,194	6.5	1.4	89.9	99	114,669	17,237	6.7	1.4	94.6
Conejo	36	231	214	1.1	21.5	3.3	40	1,786	3,040	0.6	4.6	41.3
Ojai	70	36,095	11,889	3.0	1.6	93.8	66	20,005	5,717	3.5	2.2	47.1
Piru	106	85,409	14,704	5.8	3.2	76.6	97	79,281	15,886	5.0	3.1	89.0
Rincon	28	622,288	4,451	139.8	28.5	87.8	33	571,021	5,388	106.0	21.8	88.7
Santa Paula	28	14,012	4,452	3.1	1.5	87.8	27	9,400	3,379	2.8	1.0	68.0
Sespe	35	31,837	3,592	8.9	0.2	56.7	24	26,959	4,049	6.7	0.1	91.7
Simi	52	22,542	8,332	2.7	1.1	88.5	50	21,335	8,428	2.5	1.4	91.6
South Mountain	79	609,062	12,319	49.4	0.8	86.2	85	607,569	14,293	42.5	0.6	91.4
Ventura	158	10,271,553	26,429	388.6	43.1	92.4	187	10,733,498	30,728	349.3	40.0	89.3
Totals	710	11,818,446	105,576	111.9	13.2	82.2	708	12,185,523	108,145	112.7	13.6	83.0

Dist. 3—Arroyo Grande	6	7,798	1,065	7.3	0.4	98.1	8	16,487	1,214	13.6	1.5	82.5
Casmalia	11	15,689	1,813	8.7	104.8	91.1	10	11,332	1,754	6.5	4.3	95.3
Cat Canyon	45	356,965	6,666	53.6	2.0	81.8	36	265,794	6,001	44.3	5.9	90.6
Elwood	8	4,451,237	1,439	3,093.3	2.6	99.4	20	5,000,947	2,470	2,024.7	23.6	67.1
[d]Goleta	[a]1	2,402	[a]243	9.9	99.9	100.0	1	62	12	5.2	0.0	6.5
Lompoc	1	184	11	16.7	59.6	6.1	0	0	0	0	0	0
Moody Gulch	0	0	0	0	0	0	0	0	0	0	0	0
Santa Maria	174	500,710	24,602	20.4	38.0	78.1	155	433,912	21,319	20.4	40.1	74.8
[e]Sargent	10	5,281	1,627	3.2	0	89.9	9	4,125	1,278	3.2	0.2	77.2
[f] *Summerland	72	22,821	11,949	1.9	12.7	91.7	67	57,509	11,692	4.9	13.1	94.8
Santa Barbara Co. [g]El Capitan Dist.							1	2,795	24	116.5	0.8	13.0
Mesa District							3	19,430	281	69.1	462.6	50.9
San Luis Obispo County: Huasna Dist.							1	4,416	147	30.0	120.2	79.9
Totals	328	5,363,087	49,415	108.5	26.7	83.2	311	5,816,809	46,192	125.9	27.3	80.7
Dist. 4—Belridge-Devils Den-Lost Hills	303	829,556	51,354	16.2	27.1	93.6	313	824,744	54,107	15.2	24.5	93.9
Elk Hills	215	3,226,333	35,541	90.8	36.6	91.3	208	3,106,772	36,328	85.5	44.2	94.9
Fruitvale	5	171,506	765	224.2	7.1	84.5	12	462,250	1,918	241.0	9.3	86.9
Kern River	1,184	2,829,072	191,464	14.8	51.6	89.3	1,062	3,067,560	183,167	16.7	56.0	93.7
McKittrick-Temblor	286	821,878	48,503	16.9	75.2	93.7	280	827,611	49,112	16.9	73.8	95.3
Midway-Sunset	2,323	12,462,964	388,938	32.0	17.8	92.5	2,168	12,644,584	370,309	34.1	19.0	92.8
Mt. Poso	10	275,639	1,020	270.2	7.3	56.4	51	1,550,562	7,153	216.8	16.3	76.2
Round Mountain	2	9,745	89	109.5	19.2	24.6	8	215,187	1,028	209.3	10.5	69.8
Wheeler Ridge	34	130,206	5,823	22.4	3.2	94.6	34	120,520	6,188	19.5	2.7	98.9
Wildcat: Kern County	1	731	22	33.2	4.9	12.2						
Totals	4,363	20,757,630	723,519	28.7	32.1	91.6	4,136	22,819,790	709,310	32.2	33.8	93.2
Dist. 5—Coalinga	786	1,748,199	133,311	13.1	10.9	93.7	762	1,749,908	134,397	13.0	10.3	95.9
Kettleman Hills	2	646,232	255	2,534.2	34.2	70.4	3	1,322,497	485	2,726.8	72.2	87.9
Totals	788	2,394,431	133,566	17.9	11.0	93.6	765	3,072,405	134,882	22.8	10.5	95.8
Grand totals	10,608	142,335,618	1,759,875	80.8	35.5	91.7	10,398	150,073,579	1,767,770	84.9	35.8	92.4

* Estimated.
[a] Three wells on production in January.
[b] Seven wells produced for two months.
[c] Commercial production in December, 1929.
[d] Operations suspended July 12, 1929.
[e] Operations suspended November 19, 1929.
[f] Estimated.
[g] Well came on production in October and was closed in after producing for 24 days.

CHAPTER THREE

METALS

Bibliography: Reports of State Mineralogist I–XXVI (inc.). Bulletins 5, 6, 18, 23, 27, 36, 50, 57, 76, 78, 85, 92, 95. Spurr and Wormser, "Marketing of Metals and Minerals." See also under each metal.

The total value of metals produced in California during 1929 was $16,509,698. Chief among these is and always has been gold; followed by copper, quicksilver, tungsten, lead, platinum and manganese. There was also a small production of tin.

There was no production of antimony, arsenic, cadmium, iron ore, molybdenum, titanium, nor zinc, which have in the past been on the active list. Deposits of ores of nickel and vanadium have also been found in the state, although there has yet been no commercial output of them. The above-noted total of this group is a net increase of $11,949 from the 1928 total of $16,497,794. Copper and quicksilver showed material increases. The copper figures included a small production over the last 3 years, previously taken as secondary metal from Alameda County or they would not quite offset the decreases shown by the other metals in this group. Gold showed the largest decline in production.

California leads all states in the Union in her gold production and is credited with approximately 26% of the nation's yield in 1929. The precious metal is widely distributed through the state. Thirty-four of the fifty-eight counties reported an output in 1929 from either mines or dredges.

Copper, which is second in importance among the metals of the state, occurs in the following general districts: the Shasta County belt, which has been by far the most important; the Coast Range deposits, extending more or less continuously from Del Norte in the north to San Luis Obispo County in the south; the Sierra Nevada belt, starting in Plumas and running in a general southerly and southeasterly direction through the Mother Lode counties and ending in Kern; the eastern belt in Mono and Inyo counties, and the southern belt in San Bernardino, Riverside and San Diego counties.

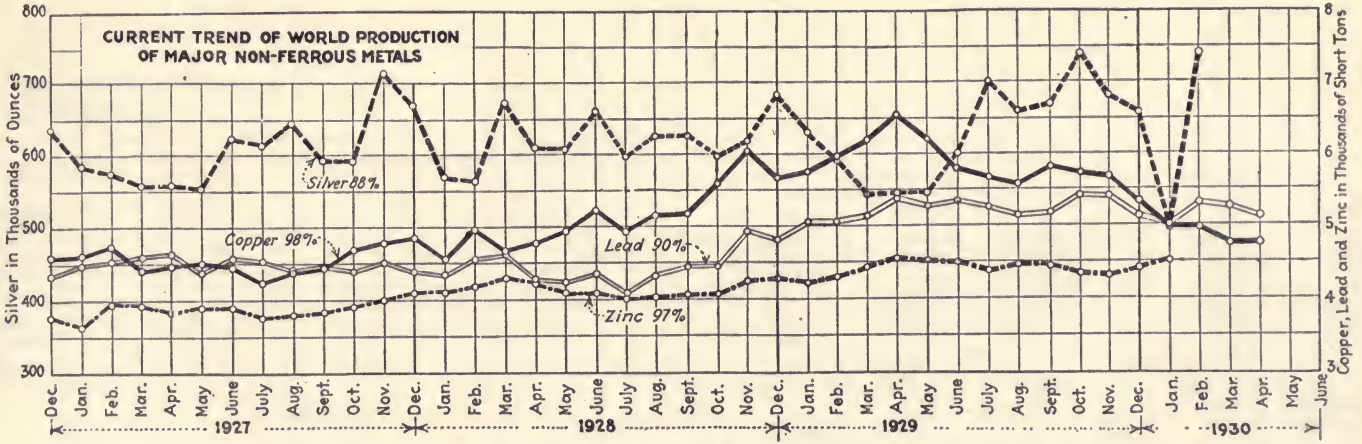
Silver is not generally found alone in the state, except notably in the Rand district, San Bernardino County; but is associated to a greater or less extent with gold, copper, lead and zinc.

Quicksilver has for many years been one of the state's staple products and California in 1929 supplied approximately 43% of the nation's output of this metal.

Tungsten is found in but few other localities of importance in the United States.

Large deposits of iron ore have long been known in several sections of the state, but for various economic reasons this branch of the mineral industry thus far has made only slight progress on the Pacific Coast.

Titanium is associated with some of California's iron deposits. This mineral is widely distributed through the United States, but the deposits



These curves are not to be considered as permanent records of production. They show merely the current trend in terms of daily output according to the latest estimates of the American Bureau of Metal Statistics. The figures represent production from countries that produce approximately 98 per cent of the world's copper, 97 per cent of the zinc, 90 per cent of the lead and 88 per cent of the silver. The zinc curve has not been plotted for the past months of 1930, owing to the absence of some European production statistics; this situation is believed to be only temporary in character. Delay in receipt of statistics from Mexico accounts for the failure of the silver curve to be up to date.—From Eng. & Min. Jour., June 23, 1930.

A comparison of the 1929 output with that of the 1928 is afforded by the following table:

Substance	1928		1929		+Increase —decrease value
	Amount	Value	Amount	Value	
Antimony	20 tons	$761			—$761
Copper	25,162,304 lbs.	3,623,360	33,809,258 lbs.	$5,941,799	+2,318,439
Gold		10,785,315		8,526,703	—2,258,612
Lead	1,882,795 lbs.	109,102	1,428,777 lbs.	90,014	—19,088
Platinum	312 fine oz.	27,902	213 fine oz.	14,416	—13,486
Quicksilver	7,107 flasks	844,649	10,152 flasks	1,195,705	+351,056
Silver	1,478,771 fine oz.	865,081	1,176,895 fine oz.	627,285	—237,796
Tungsten	*	*	150 tons	106,280	*
Unapportioned		[1]241,579		[2]7,496	—234,083
Total value		$16,497,749		$16,509,698	
Net increase					$11,949

* Under "unapportioned."
[1] Includes manganese ore, tin, titanium and tungsten.
[2] Includes manganese ore and tin.

of this state are among the few that are considered of commercial importance.

Although the United States is a large consumer of certain metals, in fact the largest particularly of chromium and tin, our production from domestic sources is deficient. We have large reserves of low-grade chromite, manganese, tungsten and antimony ores, but they do not fully supply our commercial needs.

ALUMINUM

Bibliography: Report XVIII, p. 198. Bulletins 38, 67. U. S. Geol. Surv., Min. Res. of U. S.

To date there has been no commercial production of aluminum ore in California. Only a single authenticated occurrence of bauxite has thus far been noted in this state, being in Riverside County, southeast of Corona, but as yet undeveloped.

Minerals containing aluminum are abundant, the most widely distributed being the clays. There are only two, however, thus far of consequence commercially, in the production of the metal: bauxite (to which may be added the related hydrated oxides, hydrargillite and diaspore) and cryolite. Cryolite is found in commercial quantities only in south Greenland, and was formerly the only ore of aluminum used, being still employed as a flux in the extraction of the metal. Bauxite has been for some years the most important source of aluminum and its salts. Its color varies from gray to red, according to the amount of iron present, the composition ranging usually between the following limits: Al_2O_3, 30%–60%; Fe_2O_3, 3%–25%; SiO_2, 0.5%–20%; TiO_2, 0.0–10%. Besides its reduction to the metal bauxite is also utilized in the manufacture of aluminum salts, refractory bricks, alundum (fused alumina) for use as an abrasive, and in the refining of oil. The most important producing countries, both of bauxite and the metal, are the United States and France. The United States leads with 36% of world's output of the metal, although France produces more bauxite than any other country. In 1913 France led.

ANTIMONY

Bibliography: State Mineralogist Reports VIII, X, XII–XV (inc.), XVII, XXII, XXIII, XXV. Bulletins 38, 91.

During 1929 there were no shipments of antimony ore in California, although there was a small tonnage mined in Kern County. In 1928 there was mined and sold a total of 20 tons of antimony ore calculated at 45% antimony valued at $761 by four producers, one in Kern County and three in San Bernardino County. There now is a smelter in Los Angeles handling antimony ore and most of the California producers ship their ore there for treatment.

Production of antimony in California has been irregular, and small in amount except during 1915–17 when the high war-time prices permitted American producers, for a short period, to compete with Chinese antimony. The principal commercial production of antimony in California has come from Kern, Inyo and San Benito counties, and other occurrences have been noted in Nevada, Riverside and Santa Clara counties. The commonest occurrence is in the form of the sulphide,

stibnite; but in the Kernville and Havilah districts in Kern County there were notable deposits of the native metal, being among the few localities of the world where native antimony has been found. There was a small production reported from San Benito County and development work on properties both in Kern and San Benito counties.

California producers claim they can not operate profitably unless the price of antimony be above 12 cents per pound. During most of 1925 and 1926 the price was up, at times as high as 23¢, and as a consequence there was some revival of antimony mining in California. Present New York quotations (July 31, 1930) are around 7¼¢ per pound for Chinese brands. China is the principal world source of antimony.

The antimony market (New York being the chief center) is recognized as one of the most unstable of the metal markets. As the world's requirements for antimony are comparatively small, the prices react sharply if an extra quantity of the metal be thrown onto the market, and the trade becomes so cautious that the market may disappear altogether, causing production to fall off rapidly.

Pure antimony metal and manufactured antimony compounds are of considerable importance as pigments in the ceramic industry. The most important use of the metal, commercially, is in various alloys, particularly type-metal (with tin and lead), babbitt (with tin and copper), and britannia metal (with tin and copper). An alloy of 6% antimony and 94% lead is being extensively used in making battery plates for storage batteries for automobiles, airplanes and radio apparatus.

Antimony Production in California, by Years.

The production of antimony ore in California by years since 1887 has been as follows:

Year	Tons	Value	Year	Tons	Value
1887	75	$15,500	1902		
1888	100	20,000	1915	510	$35,666
1889			1916	1,015	64,793
1893	50	2,250	1917	158	18,786
1894	150	6,000	1918		
1895	33	1,485	1925	*26	770
1896	17	2,320	1926		
1897	20	3,500	1927	20	590
1898	40	1,200	1928	20	761
1899	75	13,500	1929		
1900	70	5,700			
1901	* 50	8,350	Totals	2,429	$201,171

* Annual details concealed under 'Unapportioned.'

ARSENIC

Bibliography: Reports XVIII, XXIII, XXV. Bulletin 67, U. S. G. S., Min. Res. of U. S.

Arsenic is found in a number of localities in California in the mineral arsenopyrite (FeAsS), which is frequently gold bearing; and in scorodite ($FeAso_4+2H_2O$), an oxidation product of arsenopyrite. The occurrence of realgar (AsS) has also been noted. The principal source of the arsenic of commerce in the United States has been as a by-product from the metallurgical treatment of copper, gold, and lead ores. It is

usually recovered in the form of the tri-oxide, or 'white arsenic,' for which there is a demand for the preparation of insecticides, for use in agriculture and horticulture, and especially against the cotton-boll weevil in the southern states.

During the year there was some activity in opening up an arsenic mine at Lake Hodges in San Diego County, but as yet there has been no shipment or production.

Except for a small output in 1924, there has been no commercial recovery of arsenic from Californian ores. There having been only a single operator, the figures are concealed under the 'Unapportioned' item.

BERYLLIUM

Bibliography: Eng. & Min. Jour.-Press, Vol. 118, No. 8, p. 285, Aug. 23, 1924. U. S. Bureau of Mines Information Circular 6190.

Beryllium is a metal resembling aluminum closely in its chemical character, and has a specific gravity of 1.85. Several alloys have been prepared experimentally, of which copper-beryllium has received the most attention. The addition of 5% beryllium produces a golden-yellow alloy. The compounds of beryllium at present used commercially are the nitrate and oxide. The nitrate is used by incandescent mantle manufacturers to harden the thorium oxide skeleton, and the oxide has been added to materials being used for the manufacture of abrasive compounds and in dental cements. Beryllium sulphate has been used to some extent in medical research.

There are a number of beryllium minerals, but none have been found in commercial quantities, except beryl, which is a beryllium-aluminum silicate. The chief use at present for ground beryl is as an addition to porcelain products, where it reduces the coefficient of expansion. Beryllium metal is difficult to separate from aluminum.

Beryl occurs in California in the pegmatite dikes of the tourmaline gem district in northern San Diego and southwestern Riverside counties. Thus far there have been no commercial shipments of beryl except for gem purposes (the pink and aquamarine varieties).

BISMUTH

Bibliography: Bulletins 38, 67, 91. Am. Jour. Sci., 1903, Vol. 16.

Several bismuth minerals have been found in California, notably native bismuth and bismite (the ochre) in the tourmaline gem district in San Diego and Riverside counties near Pala. Other occurrences of bismuth minerals, including the sulphide, bismuthinite, have been noted in Inyo, Fresno, Nevada, Tuolumne, San Bernardino, and Mono counties, but only in small quantities. The only commercial production recorded was 20 tons valued at $2,400, in 1904, and credited to Riverside County. Recovery of bismuth from blister copper in the electrolytic refinery has been noted. In the United States, the principal recovery of bismuth is obtained as a by-product from the refining of lead bullion.

The uses of bismuth are somewhat restricted, being employed principally in the preparation of medicinal salts, and in low melting-point or cliché alloys. These alloys are utilized in automatic fire sprinkler systems in electric fuses, and in solders.

Present quotations for bismuth are around $1.00 per pound, in ton lots for the refined metal.

CADMIUM

Bibliography: U. S. Geol. Surv., Min. Res. of U. S., 1908, 1918.

During 1917 and 1918, cadmium metal was recovered by the electrolytic zinc plant of the Mammoth Copper Company in Shasta County It was shipped in the form of 'sticks' and amounted to a total of several thousand pounds for the two years, the exact figures being concealed under 'Unapportioned.' That was the first, and thus far the only, commercial production of cadmium recorded from California ore. Cadmium occurs there associated with zinc sulphide, sphalerite. Cadmium also occurs in the Cerro Gordo Mine, Inyo County, associated with smithsonite (zinc carbonate).

There are several cadmium minerals, but none of them occur in sufficient quantities individually to be profitable as distinct ores. The cadmium of commerce is derived as a by-product in the reduction of zinc minerals and ores, in nearly all of which it occurs in at least minute proportions, the average ratio being about 1 of cadmium to 200 of zinc. As cadmium behaves metallurgically much the same as zinc, it constitutes a fraction of 1 per cent of nearly all metallic zinc.

Cadmium is produced in the United States in two forms—metallic cadmium and the pigment, cadmium sulphide. The principal use of the metal is in low-melting point, or cliché alloys, and its salts are utilized in the arts, medicine, and in electroplating. The sulphide is employed as a paint pigment, being a strong yellow, which is unaffected by hydrogen sulphide gas from coal smoke. It is also employed in coloring glass and porcelain. Cadmium cliché metal is stated to be superior to the corresponding bismuth alloy, for making stereotype plates. Cadmium is also used in bronze telegraph and telephone wires, and gives some promise of being utilized in electroplating.

Present quotations for cadmium are 70¢ per pound for the refined metal.

COBALT

Bibliography: Report XIV. Bulletins 67, 91. U. S. G. S., Min. Res. of U. S., 1912, 1918.

Occurrences of some of the cobalt minerals have been noted in several localities in California, but to date no commercial production has resulted. Some of the copper ores of the foothill copper belt in Mariposa and Medera counties have been found to contain cobalt up to 3%. The most notable occurrence thus far found in this state is in the Mar-John Mine near Sheep Ranch, Calaveras County. Lenses of smaltite ($CoAs_2$), have been uncovered in the vein, there, and several tons taken out in the course of development work; but as yet there have been no commercial shipments.

The most important use of cobalt is in the manufacture of the alloy, stellite, in which it is combined with chromium, for making high-speed lathe tools, and non-tarnishing cutlery and surgeons' appliances. The metal is also used in electroplating, similarly to nickel; and the oxide, carbonate, chloride, sulphate and other salts are used in ceramics for

coloring. Some of the organic salts of cobalt (acetate, resinate, oleate) are employed as 'driers' in paint and varnish.

The nominal quotation for cobalt is around $2.50 per pound for the refined metal.

COPPER

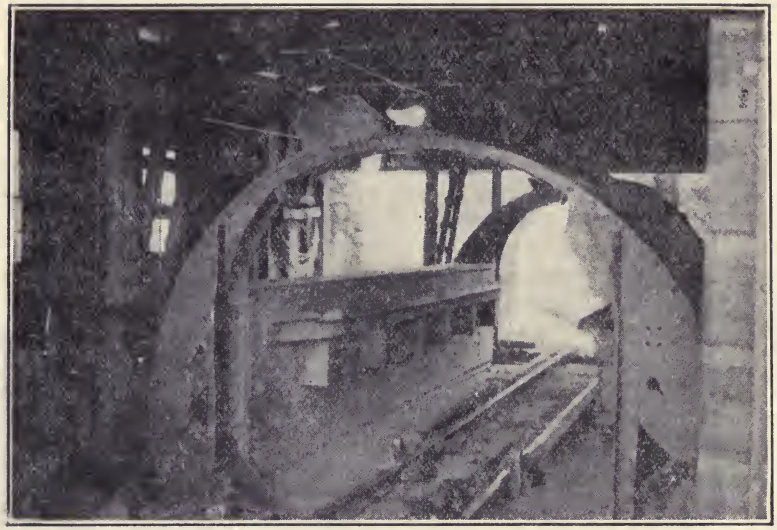
Bibliography: State Mineralogist Reports VIII–XXVI (inc.). Bulletins 23, 50, 91.

Copper is second only to gold among the metals mined in California. The output for 1929 amounted to a total of 33,809,258 pounds recoverable metal valued at $5,941,799. This was an increase in both amount

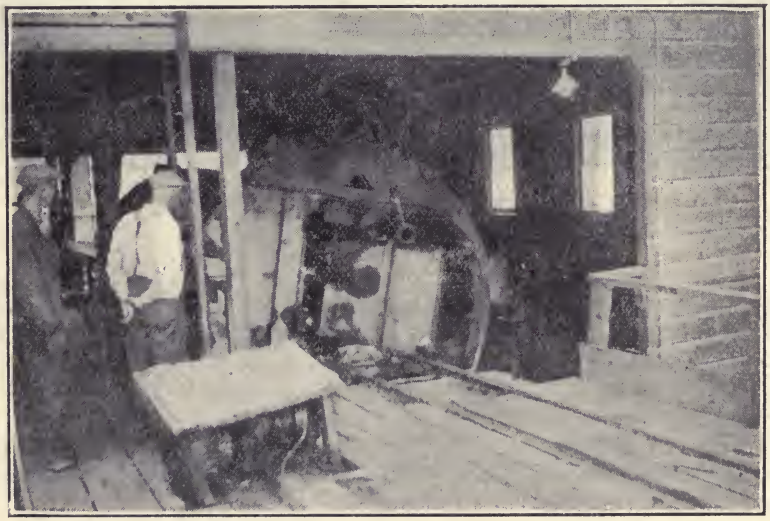
Mill of Engels Copper Mining Company, Engelmine, Plumas County.
Photo by Walter W. Bradley.

and value over the 1928 figures which were 25,162,304 pounds and $3,623,360. The 1929 figures include also a small production over the past three years coming from Alameda County, for which reports had not been previously received. The average price of copper for 1929 was 17.6 cents per pound compared with 14.4 cents a pound in 1928.

Plumas County ranked first, as it has for several years past, in the production of copper for 1929, with an output of 25,253,603 pounds, Shasta County came second with 6,066,098 pounds and Calaveras County third with 1,200,494 pounds.



Mechanical ore-car dumper at Engels Copper Mine.
Photo by Walter W. Bradley.



Ore-car in mechanical dumper at Engels Copper Mine.
Photo by Walter W. Bradley.

Distribution of the 1929 copper output in California by counties was as follows:

County	*Pounds*	*Value*
Alameda	321,844	$48,016
Alpine	7,260	1,278
Calaveras	1,200,494	211,287
Del Norte	5,002	880
Humboldt	64,553	11,361
Inyo	17,733	3,121
Los Angeles	1,981	349
Madera	19,254	3,389
Mariposa	6,302	1,109
Mono	16,552	2,913
Napa	4,356	767
Nevada	5,702	1,004
Plumas	25,253,603	4,444,634
Riverside	1,471	259
San Bernardino	81,846	14,405
Shasta	6,066,098	1,067,633
Siskiyou	34,704	6,108
Trinity	615,579	108,342
Tuolumne	82,383	14,499
Amador, El Dorado, Fresno, Orange*	2,541	445
Totals	33,809,258	$5,941,799

* Combined to conceal the output of a single operator in each.

Copper Production of the United States.

According to preliminary data issued by the U. S. Bureau of Mines,[1] the smelter production of primary copper from domestic sources during 1929 amounted to 2,002,863,135 pounds, an increase of approximately 10%. The value of smelter production increased approximately 34% in 1929. The average price of 3,215,000,000 pounds of copper delivered during the year, as reported to the Bureau of Mines by selling agencies, was 17.6¢ per pound.

REFINED COPPER

The total production of new refined copper in 1929 was 2,740,000,000 pounds, an increase of 252,000,000 pounds over that in 1928.

PRIMARY AND SECONDARY COPPER PRODUCED BY REGULAR REFINING PLANTS AND IMPORTED, 1928-1929, IN POUNDS

	1928	*1929*
Primary:		
Domestic:[2]		
Electrolytic	1,607,120,026	1,785,754,654
Lake	179,104,311	185,300,917
Casting	5,573,050	11,676,718
	1,791,797,387	1,982,732,289
Foreign:[2]		
Electrolytic	693,787,036	756,555,087
Casting	2,023,356	825,000
Refinery production of new copper	2,487,607,779	2,740,112,376
Imports of refined copper	84,730,630	134,014,792
Total new refined copper made available	2,572,338,409	2,874,127,168
Secondary:		
Electrolytic	191,323,029	331,858,103
Casting	41,322,776	2,300,000
	232,645,805	334,158,103
Grand totals	2,804,984,214	3,208,285,271

[1] U. S. Bureau of Mines, Press Bulletin, May 14, 1930.

[2] The separation of refined copper into metal of domestic and foreign origin is only approximate, as an accurate separation of the amounts at this state of manufacture is not possible.

In addition to their output of metallic copper the regular refining companies produced bluestone (hydrous copper sulphate) having a copper content of 10,255,000 pounds, as compared with 11,326,000 pounds in 1928.

STOCKS

Stocks of copper January 1, 1925, 1926, 1927, 1928, 1929 and 1930 in pounds

Year	*Refined copper*	*Blister and material in process of refining* [1]
1925	243,000,000	393,000,000
1926	124,000,000	432,000,000
1927	146,000,000	455,000,000
1928	171,000,000	401,000,000
1929	114,000,000	423,000,000
1930	306,000,000	500,000,000

CONSUMPTION

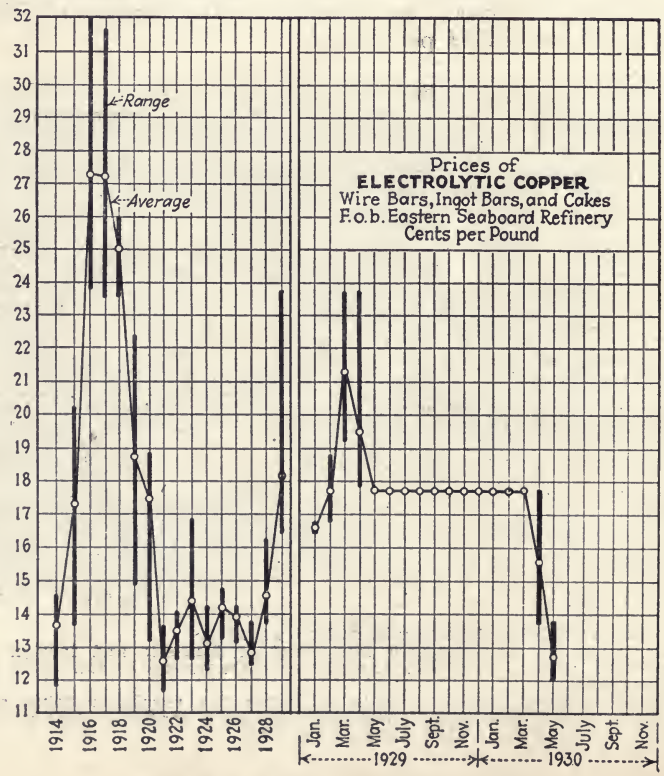
The new refined copper withdrawn from the total year's supply on domestic account in the United States in 1929 and the method employed in determining it are shown in the following table, which does not include stocks of copper held by consumers.

NEW REFINED COPPER WITHDRAWN FROM TOTAL YEAR'S SUPPLY ON DOMESTIC ACCOUNT, 1928-1929, IN POUNDS

	1928	*1929*
Total supply of new copper	2,572,338,409	2,874,127,168
Stock at beginning of year	171,000,000	114,000,000
Total available supply	2,743,338,409	2,988,127,168
Copper exported [2]	1,020,799,531	903,541,753
Stock at end of the year	114,000,000	306,000,000
Totals	1,134,799,531	1,209,541,753
Withdrawn on domestic account	1,608,538,878	1,778,585,415

[1] The amounts stated in the last column in the table above do not include copper in stock at foreign smelters or in transit from foreign smelters to refineries in the United States.

[2] Includes refined copper in ingots, bars, rods, or other forms.



From Eng. & Min. Jour., June 23, 1930.

Copper Production of California, by Years.

Although some mining of copper ores in a small way had been done earlier, shipments in appreciable quantities began in 1861 and continued of importance up to the end of 1867, when a total of 68,631 tons (of 2376 pounds) of high-grade ores, and 847 tons of matte or 'regulus'[1] had been shipped to smelters at New York, Boston, and Swansea, Wales. The most important district at that time was Copperopolis and vicinity in Calaveras County, with some shipments also made from Mariposa, El Dorado, Fresno and San Luis Obispo counties. From 1868 to 1882, the output was insignificant. There are wide discrepancies in the figures currently recorded for copper production previous to 1882, in which year the data of the U. S. Geological Survey began. The detailed statistics of the California State Mining Bureau began in the year 1894.

Amount and value of copper production in California annually since 1882 is given in the following tabulation:

Copper Production of California, by Years

Year	Pounds	Value	Year	Pounds	Value
1882	826,695	$144,672	1907	32,602,945	$6,341,387
1883	1,600,862	265,743	1908	40,868,772	5,350,777
1884	876,166	120,911	1909	65,727,736	8,478,142
1885	469,028	49,248	1910	53,721,032	6,680,641
1886	430,210	43,021	1911	36,838,024	4,604,753
1887	1,600,000	192,000	1912	34,169,997	5,638,049
1888	1,570,021	235,303	1913	34,471,118	5,343,023
1889	151,505	18,180	1914	30,491,535	4,055,375
1890	23,347	3,502	1915	40,968,966	7,169,567
1891	3,397,405	424,675	1916	55,809,019	13,729,017
1892	2,980,944	342,808	1917	48,534,611	13,249,948
1893	239,682	21,571	1918	47,793,046	11,805,883
1894	738,594	72,486	1919	22,162,605	4,122,246
1895	225,650	21,901	1920	12,947,299	2,382,303
1896	1,992,844	199,519	1921	12,088,053	1,559,358
1897	13,638,626	1,540,666	1922	22,883,987	3,090,582
1898	21,543,229	2,475,168	1923	28,346,860	4,166,989
1899	23,915,486	3,990,534	1924	52,089,349	6,823,704
1900	29,515,512	4,748,242	1925	46,968,499	6,669,527
1901	34,931,788	5,501,782	1926	33,521,544	4,693,014
1902	27,860,162	3,239,975	1927	27,350,316	3,582,888
1903	19,113,861	2,520,997	1928	25,162,304	3,623,360
1904	29,974,154	3,969,995	1929	33,809,258	5,941,799
1905	16,997,489	2,650,605			
1906	28,726,448	5,522,712	Totals	1,102,666,583	$177,418,548

GOLD

Bibliography: State Mineralogist Reports I to XXVI (inc.), (except III and VIII). Bulletins 36, 45, 57, 91, 92, 95. U. S. Geol. Surv., Prof. Paper 73.

Gold was the first, and, for many years, the most important single mineral product of California. Although now surpassed for a number of years in annual value by petroleum, and by cement beginning with 1920, it still heads our metal list, and California continues to outrank all the other gold-producing states of the United States, including Alaska. In fact, at present, California is producing approximately 26% of the gold mined in the entire United States.

While there is some renewal of activity in the development of gold placer properties, it has not yet become reflected in an increased yield of the metal. In fact, the 1929 figures show a decrease from the 1928 values.

[1] Brown, J. Ross, Mineral Resources West of the Rocky Mountains, p. 168, 1867.

The gold yield has decreased in recent years, not only in California but in the country as a whole. Meanwhile, the actual gold reserves (monetary stock on hand) of the United States has increased to such an extent that we now hold practically one-half of the world's stock.

The production of gold in California in 1929 totaled 412,479.25 fine ounces worth $8,526,703, being a decrease of 109,260.34 fine ounces from the 1928 yield. The deep or lode mines output accounted for $4,656,096 and the placers (mainly the dredges) produced $3,870,607. As the Division of Mines has never independently gathered the statistics of gold and silver production, these figures, as in former years, are published by cooperation with and through the courtesy of Mr. V. C. Heikes of the Division of Minerals and Statistics, U. S. Bureau of Mines.

The largest gold production for 1929 is reported from Nevada County with an output of 87,443.30 fine ounces ($1,807,613); Amador County second with 77,490.04 fine ounces ($1,601,861); Sacramento County third with 72,179.49 fine ounces ($1,492,083); Yuba County fourth with 70,435.88 fine ounces ($1,456,039); followed by Plumas and Sierra counties. It will be noted that Nevada held first place as a gold producing county with an output exceeding that of Yuba or Amador, which held first and second places respectively in 1928 with Sacramento fourth that year. The gold from Yuba and Sacramento comes almost entirely from dredges, while that from Nevada and Amador counties comes mainly from the lode mines.

Distribution of the 1929 gold output by counties was as follows:

County	*Value*	*County*	*Value*
Amador	$1,601,861	Orange	$29
Butte	71,917	Placer	34,691
Calaveras	103,843	Plumas	391,682
El Dorado	57,680	Riverside	244
Fresno	13,575	Sacramento	1,492,083
Humboldt	2,372	San Bernardino	44,984
Imperial	1,030	San Diego	1,282
Inyo	16,889	San Luis Obispo	1,267
Kern	148,421	Shasta	89,689
Lassen	168	Sierra	367,396
Los Angeles	991	Siskiyou	63,843
Madera	1,474	Stanislaus	128,872
Mariposa	91,052	Trinity	352,029
Merced	84,188	Tuolumne	70,957
Mono	10,025	Ventura	473
Monterey	263	Yuba	1,456,039
Napa	17,781		
Nevada	1,807,613	Total value	$8,526,703

The following is quoted from the advance statement of gold in 1929 by courtesy of the U. S. Bureau of Mines, Department of Commerce:

"The total recoverable gold in ore and gravels treated in California in 1929 was valued at $8,526,703, of which 324 lode mines yielded $4,656,096 and 478 placers (including dredges) $3,870,607. Compared with the gold yield in 1928 this was a decrease of $2,258,612 and the greatest decrease since the 1920 drop from 1919. Much of the loss in 1929 is accounted for by the decreased output of the dredges, though lode mines yielded $1,278,590 less than in 1928. Of the total gold yield in 1929 lode mining produced 55 per cent and placer mining 45 per cent. Only 4 counties had a production of gold exceeding $1,000,000 and these, in order of rank, were Nevada, Amador, Sacramento, and Yuba (first in 1928). Of the lode gold output gold ore and tailings yielded 90 per cent, copper ore, tailings, etc., 9 per cent, and silver ore 1 per cent. Of the placer gold output dredges yielded 93 per cent, surface placers 3 per cent, drift placers 2 per cent, and hydraulic placers 2 per cent. The gold output of 25 dredges (24 in 1928) was 19 per cent less than in the preceding year. One dredge in 1929 was an experimental affair and made only a test run. Twenty-six companies in the state produced more than 1000 ounces of gold each and contributed nearly 90 per cent of the total gold output."

Total Gold Production of California.

The presence of gold in stream gravels near Los Angeles was known and worked in a small way by the Indians, at least as early as 1841,[1] and possibly 1820.[2] On March 2, 1844, Don Manuel Castanares, deputy for California to the Congress of Mexico, reported[3] to his government that placers near Los Angeles had produced up to December, 1843, a total of 2000 ounces of gold dust, most of which had been sent to the United States Mint at Philadelphia.

As the padres and the rancheros discouraged the quest of gold this early, small production caused no particular excitement. It was not until James W. Marshall's finding of gold nuggets in the tail-race of Sutter's saw mill on the American River, January 24, 1848, was heralded abroad that the great rush began, and California became a commonwealth of first rank almost over night. There are, however, no authentic data on gold production prior to 1848, other than occasional, scattered references such as above quoted.

The following table was originally compiled by Chas. G. Yale, of the Division of Mineral Resources, U. S. Geological Survey, but for a number of years statistician of the California State Mining Bureau and the U. S. Mint at San Francisco. The authorities chosen for certain periods were: J. D. Whitney, state geologist of California; John Arthur Phillips, author of "Mining and Metallurgy of Gold and Silver" (1867); U. S. Mining Commissioner R. W. Raymond; U. S. Mining Commissioner J. Ross Browne; Wm. P. Blake, Commissioner from California to the Paris Exposition, where he made a report on "Precious Metals" (1867); John J. Valentine, author for many years of the annual report on precious metals published by Wells, Fargo & Company's Express; and Louis A. Garnett, in the early days manager of the San Francisco refinery, where records of gold receipts and shipments were kept. Mr. Yale obtained other data from the reports of the director of the U. S. Mint and the director of the U. S. Geological Survey. The authorities referred to who were alive at the time of the original compilation of this table in 1894 were all consulted in person or by letter by Mr. Yale with reference to the correctness of their published data, and the final table quoted was then made up.

The figures for 1903–1923 (inclusive) are those prepared by the U. S. Geological Survey; and since by the U. S. Bureau of Mines:

[1] Hittell, T. H., History of California: Vol. II, p. 312, 1885.
[2] Bancroft, H. H., History of California: Vol. II, p. 417, 1886.
[3] Mercantile Trust Review of the Pacific, Vol. XIV, No. 2, p. 43, Feb. 15, 1925.

Total Gold Production of California

Year	Value	Year	Value
1848	$245,301	1890	$12,309,793
1849	10,151,360	1891	12,728,869
1850	41,273,106	1892	12,571,900
1851	75,938,232	1893	12,538,780
1852	81,294,700	1894	13,863,282
1853	67,613,487	1895	15,334,317
1854	69,433,931	1896	17,181,562
1855	55,485,395	1897	15,871,401
1856	57,509,411	1898	15,906,478
1857	43,628,172	1899	15,336,031
1858	46,591,140	1900	15,863,355
1859	45,846,599	1901	16,989,044
1860	44,095,163	1902	16,910,320
1861	41,884,995	1903	16,300,653
1862	38,854,668	1904	18,633,676
1863	23,501,736	1905	18,898,545
1864	24,071,423	1906	18,732,452
1865	17,930,858	1907	16,727,928
1866	17,123,867	1908	18,761,559
1867	18,265,452	1909	20,237,870
1868	17,555,867	1910	19,715,440
1869	18,229,044	1911	19,738,908
1870	17,458,133	1912	19,713,478
1871	17,477,885	1913	20,406,958
1872	15,482,194	1914	20,653,496
1873	15,019,210	1915	22,442,296
1874	17,264,836	1916	21,410,741
1875	16,876,009	1917	20,087,504
1876	15,610,723	1918	16,528,953
1877	16,501,268	1919	16,695,955
1878	18,839,141	1920	14,311,043
1879	19,626,654	1921	15,704,822
1880	20,030,761	1922	14,670,346
1881	19,223,155	1923	13,379,013
1882	17,146,416	1924	13,150,175
1883	24,316,873	1925	13,065,330
1884	13,600,000	1926	11,923,481
1885	12,661,044	1927	11,671,018
1886	14,716,506	1928	10,785,315
1887	13,588,614	1929	8,526,703
1888	12,750,000		
1889	11,212,913	Total value	$1,832,205,032

IRIDIUM (see under Platinum)

IRON ORE

Bibliography: State Mineralogist Reports II, IV, V, X, XII–XV (inc.), XVII, XVIII, XXI–XXV (inc.). Bulletins 38, 67, 91. Am. Inst. Min. Eng., Trans. LIII. Min. & Sci. Press, Vol. 115, pp. 112, 117–122; Vol. 123, pp. 94–96, 113–114.

There was no commercial production of iron ore in California during 1929, although there was a tonnage utilized in the manufacture of paint pigments and which is credited to "mineral paint" in this statistical report. The iron ore (magnetite) mined during the past few years from beach sands was used as a foundry flux and in steel refining at open-hearth plants.

There are considerable deposits of iron ore known in California, notably in Shasta, Madera, Placer, Riverside, San Bernardino and Los Angeles counties, but production has so far been limited for lack of an economic supply of cooking coal. Some pig iron has been made, utilizing charcoal for fuel, both in blast furnaces and by electrical reduction; also, ferrochrome, ferromanganese, and ferrosilicon have been made in California.

Total Iron Ore Production of California.

Total iron ore production of California, with annual amounts and values, is as follows:

Year	Tons	Value	Year	Tons	Value
1881*	9,273	$79,452	1914	1,436	$5,128
1882	2,073	17,766	1915	724	2,584
1883	11,191	106,540	1916	3,000	6,000
1884	4,532	40,983	1917	2,874	11,496
1885			1918	3,108	15,947
1886	3,676	19,250	1919	2,300	13,796
1887			1920	5,975	40,889
1893	250	2,000	1921	1,970	12,030
1894	200	1,500	1922	3,588	18,868
1895			1923	3,102	18,665
1907	400	400	1924		
1908			1925	785	4,710
1909	108	174	1926		
1910	579	900	1927	5,272	26,000
1911	558	558	1928		
1912	2,508	2,508	1929		
1913	2,343	4,485			
			Totals	71,805	$552,629

* Productions for the years 1881-1886 (inc.) were reported as "tons of pig iron" (U. S. G. S., Min. Res. 1885), and for the table herewith are calculated to "tons of ore" on the basis of 47.6% Fe as shown by an average of analyses of the ores (State Mineralogist Report IV, p. 242). This early production of pig iron was from the blast furnaces then in operation at Hotaling in Placer County. Charcoal was used in lieu of coke. Though producing a superior grade of metal, they were obliged finally to close down, as they could not compete with the cheaper English and eastern United States iron brought in by sea to San Francisco.

[a] Annual details concealed under 'Unapportioned.'

LEAD

Bibliography: State Mineralogist Reports IV, VIII–XV (inc.), XVII–XXVI (inc.).

The production of lead in California in 1929 was 1,428,777 pounds of recoverable metal valued at $90,014, as compared with the 1928 figures, which were 1,882,795 pounds valued at $109,102. The average value of lead in 1929 was 6.3 cents per pound; in 1928 was 5.8 cents per pound and in 1927 was 6.3 cents per pound.

As in the past the principal output of lead was from the lead-silver ores of Inyo County.

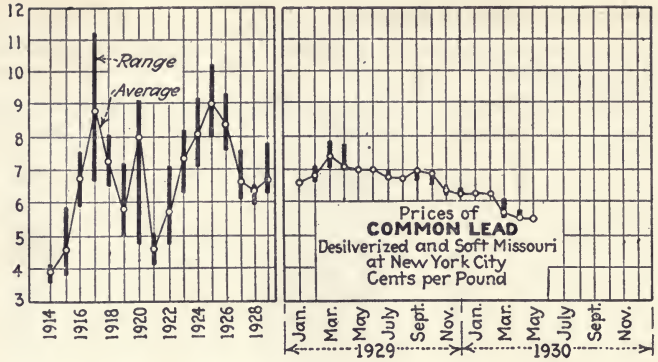
Distribution of the 1929 lead output by counties was as follows:

County	*Pounds*	*Value*
Calaveras	8,277	$521
Inyo	1,335,831	84,157
Mono	19,602	1,235
Nevada	6,603	416
Orange	1,471	93
San Bernardino	53,532	3,373
Amador, Napa, Plumas, Sacramento, Siskiyou, Tuolumne*	3,461	219
Totals	1,428,777	$90,014

* Combined to conceal output of a single operator in each.

In 1929 the production of refined primary lead in the United States was 672,498 short tons valued at $84,735,000, as shown by report of the United States Bureau of Mines,[1] this being an increase from the national production of 1928 of 626,202 short tons valued at $72,639,432 due to increased selling price of lead from 5.8 cents a pound in 1928 to 6.3 cents in 1929.

[1] U. S. Bureau of Mines, Press Bull., May 10, 1930.



From Eng. & Min. Jour., June 23, 1930.

Lead Production of California, by Years.

Statistics on lead production in California were first compiled by this Bureau in 1887. Amount and value of the output, annually, with total figures, to date, are given in the following table:

Year	Pounds	Value	Year	Pounds	Value
1877	[a] 7,836,000	$391,800	1904	124,000	$5,270
1878	8,640,000	328,320	1905	533,680	25,083
1879	4,502,000	191,335	1906	338,718	19,307
1880	4,200,000	215,460	1907	328,681	16,690
1881	6,680,000	325,316	1908	1,124,483	46,663
1882	[b] 4,000,000	196,800	1909	2,685,477	144,897
1883	[c] 3,400,000	145,520	1910	3,016,902	134,082
1884	3,200,000	120,512	1911	1,403,839	63,173
1885	2,000,000	80,900	1912	1,370,067	61,653
1886	2,000,000	93,400	1913	3,640,951	160,202
1887	[d] 1,160,000	52,200	1914	4,697,400	183,198
1888	900,000	38,250	1915	4,796,299	225,426
1889	940,000	35,720	1916	12,392,031	855,049
1890	800,000	36,000	1917	21,651,352	1,862,016
1891	1,140,000	49,020	1918	13,464,869	956,006
1892	1,360,000	54,400	1919	4,139,562	219,397
1893	666,000	24,975	1920	4,903,738	392,300
1894	950,000	28,500	1921	1,149,051	51,707
1895	1,592,400	49,364	1922	6,511,280	358,120
1896	1,293,500	38,805	1923	9,934,522	695,416
1897	596,000	20,264	1924	4,984,387	398,751
1898	655,000	23,907	1925	7,352,422	639,661
1899	721,000	30,642	1926	8,067,873	645,429
1900	1,040,000	41,600	1927	2,748,440	173,151
1901	720,500	28,820	1928	1,882,795	109,102
1902	349,440	12,230	1929	1,428,777	90,014
1903	110,000	3,960			
			Totals	186,123,436	$11,189,783

[a] Quantities for 1877–1881 (inc.) from C. E. Siebenthal, Mineral Resources of U. S. 1912, Part I, U. S. Geol. Survey, p. 339; and values for same years from quotations in Eng. & Min. Jour. of New York.
[b] Estimated.
[c] Quantities and values for 1883–1886 (inc.) from Mineral Resources of U. S. Geol. Surv., 1883–1886, respectively.
[d] Data from 1887 to date from reports of California State Mining Bureau.

MANGANESE

Bibliography: State Mineralogist Reports XII-XV (inc.), XVIII, XXII–XXV (inc.). Bulletins 38, 67, 76, 91. U. S. G. S., Bull. 427. Eng. & Min. Jour.-Press, Vol. 117, p. 545.

Manganese ore shipments in California during the years 1928 and 1929 amounted to 733 short tons valued at $8,216. The 1929 produc-

tion came from Plumas, San Bernardino and Stanislaus counties with a single producer in each. The 1928 production was combined to conceal the output of either of two operators that year and was somewhat less both in quantity and value than the shipments in 1929. These ores showed analyses from 42% to 52% Mn and were utilized as an alloy in steel and for the manufacture of fertilizer.

Importations of foreign manganese ores to the United States in 1929, mainly from Brazil, amounted to a total of 664,269 long tons valued at $8,450,818, compared with 427,715 tons valued at $5,395,949 in 1928.

The Tariff Act of 1930 provides for an import duty of 1¢ per pound on the metallic manganese contained, for "manganese ore (including ferruginous manganese ore) or concentrates containing in excess of 10 per centum of metallic manganese." The bulk of such ore is consumed in the large steel-producing centers of the eastern United States.

Much valuable research work has been done in recent years, particularly by companies operating in Montana and Virginia, in the benfication of manganese ores. The success of their processes appears assured. In reply to the suggestions of certain steel interests to have the manganese import duty removed, the manganese operators organized the American Manganese Producers' Association, which actively worked for retention of the tariff. Such retention will enable the domestic industry to grow and to further develop ore-dressing methods that will make available large tonnages of low-grade material not now marketable.

Manganese Ore Production in California, by Years.

Production of manganese ore in California began at the Ladd Mine, San Joaquin County, in the Tesla District in 1867. When shipments of this ore to England ceased late in 1874, upwards of 5000 tons had been produced by that property. For some years following that, the output was small. The tabulation herewith shows California's ouput of manganese ore, annually, since 1887, when the compilation of such figures was begun by the State Mining Bureau:

Year	Tons	Value	Year	Tons	Value
1887	1,000	$9,000	1909	3	$75
1888	1,500	13,500	1910	265	4,235
1889	53	901	1911	2	40
1890	386	3,176	1912	22	400
1891	705	3,830	1913		
1892	300	3,000	1914	150	1,500
1893	270	4,050	1915	4,013	49,098
1894	523	5,512	1916	13,404	274,601
1895	880	8,200	1917	15,515	396,659
1896	518	3,415	1918	26,075	979,235
1897	504	4,080	1919	11,569	451,422
1898	440	2,102	1920	2,892	62,323
1899	295	3,165	1921	1,005	12,210
1900	131	1,310	1922	540	7,650
1901	425	4,405	1923	690	10,620
1902	870	7,140	1924	1,115	25,785
1903	1	25	1925	832	19,450
1904	60	900	1926	235	4,700
1905			1927		
1906	1	30	1928*	733	8,216
1907	1	25	1929*		
1908	321	5,785	Totals	88,244	$2,391,770

* Annual details concealed under 'Unapportioned.'

MOLYBDENUM

Bibliography: State Mineralogist Reports XIV, XVII–XXIV (inc.). Bulletins 67, 91. U. S. Bur. of Min., Bulletin 111. Proc. Colo. Sci. Soc., Vol. XI.

Molybdenum is used as an alloy constituent in the steel industry, and in certain forms of electrical apparatus. Included in the latter is its successful substitution for platinum and platinum-iridium in electric contact-making and -breaking devices. In alloys it is used similarly to and in conjunction with chromium, cobalt, iron, manganese, nickel, tungsten, and vanadium. The oxides and the ammonium salt have important chemical uses.

The two principal molybdenum minerals are: the sulphide, molybdenite; and wulfenite, lead molybdate; the former furnishing practically the entire commercial output. Molybdenite is found in or associated with acidic igneous rocks, such as granite and pegmatite. The chief commercial sources have been New South Wales, Queensland and Norway, with some also from Canada; but the United States is now able to supply its own requirements.

The growing consumption of molybdenum by alloy-steel makers in the United States has been stimulated by the fact that molybdenum alone of the steel-alloying metals can be produced commercially in the United States to an extent which avoids all necessity for importation. Another fact has been the marked adaptability of molybdenum steels to large-scale production of automobile and other parts.

The most important development of 1924-1925 was the elimination of ferromolybdenum from the market due to the substitution of calcium molybdate as the furnace addition by the entire alloy-steel industry. Calcium molybdate is stated to be not only easier and less costly to prepare, but it introduces the molybdenum into the steel bath in a much purer form, the resulting steel being superior to that made with ferromolybdenum.

Deposits of disseminated molybdenite are known in several localities in California, and in at least two places it occurs in small masses associated with copper sulphides. The only recorded commercial shipments of molybdenum ore in California were during the war 1916-1918. Some development work has been recently done on a high-grade deposit at the head of the Kaweah River, Tulare County.

The Tariff Act of 1930 provides for an import duty of 35 cents a pound for the metallic molybdenum content of molybdenum ores or concentrates.

The present quotations on molybdenum ores are 50¢ to 55¢ per pound of MoS_2 contained and on ferromolybdenum are $1.15 per pound Mo, 50%-60% Mo f.o.b. shipping point.

Molybdenum Production of California, by Years.

California's production of molybdenum ore by years is summarized in the following tabulation:

Year	*Tons*	*Value*
1916	8	$9,945
1917	243	9,014
1918	*	300
Totals	251	$19,259

* 300 pounds of 90% MoS_2 concentrate.

NICKEL

Bibliography: State Mineralogist Reports XIV, XVII, XXIV, XXV. U. S. G. S., Bulletin 640-D. U. S. Bureau of Standards, Circular 100.

Nickel occurs in the Friday Copper Mine in the Julian District, San Diego County. The ore is a nickel-bearing pyrrhotite, with some associated chalcopyrite. Some ore has been mined in the course of development work but not treated nor disposed of, as they were unable to get any smelter to handle it for them. Nickel ore has also been reported from other localities in California, but not yet confirmed.

Present quotations for nickel are around 35¢-36¢ per pound for the refined metal.

OSMIUM (see under Platinum)

PALLADIUM (see under Platinum)

PLATINUM

Bibliography: State Mineralogist Reports IV, VIII, IX, XII-XXV (inc.). Bulletins 38, 45, 67, 85, 91, 92. U. S. Geol. Surv. Bulletins 193, 285. Trans. Am. Ins. Min. Eng., Vol. 47, pp. 217-218.

In California the platinum group metals are obtained as a by-product from placer operations for gold. The major portion of it comes from the dredges working in Butte, Sacramento, Stanislaus, Shasta and Yuba counties, with a small amount coming from the hydraulic and surface-sluicing mines of Del Norte, Humboldt, Siskiyou, and Trinity counties.

The production of platinum metals in California in 1929 totaled 246 ounces crude, containing 212 fine ounces valued at $14,416 compared with 312 fine ounces valued at $27,902 in 1928. All but about one ounce of this amount came from the gold dredges. The metal was mined by a single producer in each of the following:

Sacramento, Shasta, Stanislaus and Yuba counties, Yuba having the largest production. In addition to the above there was some platinum metal recovered but not sold in Butte County.

Of the above 212 fine ounces, 149 ounces were platinum; 28 fine ounces were iridium, 27 fine ounces were osmium and 8 fine ounces were palladium and ruthenium.

Most of the platinum refiners pay for the osmiridium on the basis of its iridium content. Crude 'platinum' is really a mixture of the metals of that group, and carries varying percentages of platinum, iridium, osmiridium or iridosmine, with occasionally some ruthenium and palladium. In addition to the above-noted production, there is usually some platinum recovered as a by-product in the gold refinery of the mint, but which can not be assigned to the territory of its origin for lack of knowledge as to which lot of gold it belongs. Some platinum and palladium are also recovered in the electrolytic refining of blister copper.

Uses, Markets and Consumption.

Besides its well known uses in jewelry, dentistry and for chemicalware, an important industrial development of recent years employs platinum as a catalyzer in the 'contact process' of manufacturing con-

centrated sulphuric acid. It is also necessary for certain delicate parts of the ignition systems in automobiles, motor boats and aeroplanes. Experiments have been made to find alloys which can replace platinum for dishes and crucibles in analytical work, but so far with only slight success.

According to the U. S. Bureau of Mines, Department of Commerce,[1] the total consumption of platinum metals in the United States in 1929 was 191,619 fine ounces, an increase over that consumed in 1928, distributed as follows:

PLATINUM METALS CONSUMED IN THE UNITED STATES AS REPORTED BY REFINERS, 1928 AND 1929, BY INDUSTRIES, IN TROY OUNCES

Industry	*Platinum*	*Palladium*	*Iridium*	*Others*	*Total*	*Per cent of total*
1928						
Chemical	18,529	1,252	113	135	20,029	11
Electrical	21,316	9,150	1,525	2	31,993	17
Dental	10,990	12,270	167	10	23,377	12
Jewelry	93,468	4,965	3,260	815	102,508	55
Miscellaneous	5,431	2,136	963	850	9,380	5
Totals	149,674	29,773	6,028	1,812	187,287	100
1929						
Chemical	20,260	1,345	113	233	21,951	11
Electrical	20,746	18,856	1,014	89	40,705	21
Dental	13,051	12,156	788	236	26,231	14
Jewelry	84,039	4,451	3,737	851	93,078	49
Miscellaneous	7,234	1,048	347	1,025	9,654	5
Totals	145,330	37,856	5,999	2,434	191,619	100

STOCKS

At the end of 1929 stock of platinum metals in the hands of refiners were 82,184 ounces, an increase of 5 per cent as compared with the stocks at the end of 1928.

STOCKS OF PLATINUM METALS IN THE HANDS OF REFINERS IN THE UNITED STATES, DECEMBER 31, 1920-29, IN TROY OUNCES

Year	*Platinum*	*Palladium*	*Iridium*	*Others*	*Total*
1920	46,747	16,565	4,196	216	67,724
1921	38,514	21,042	4,991	3,113	67,660
1922	41,900	24,975	7,559	1,583	76,017
1923	36,554	26,266	5,208	2,697	70,725
1924	40,464	27,400	3,622	3,053	74,539
1925	44,024	26 740	3,720	4,609	79,093
1926	64,203	31,950	3,933	5,485	105,571
1927	68,757	24,313	4,617	4,369	102,056
1928	45,710	23,018	4,523	5,019	78,270
1929	51,853	20,154	4,716	5,461	82,184

Prices.

The prices of all the metals in the platinum group fluctuated some during 1929, according to quotations.[2] These on pure platinum were reduced from $74 to $70 a fine ounce on January 2, 1929, with a further reduction on May 10 to $68 a fine ounce, September 12 to $65 a fine ounce and on December 14 to $63 a fine ounce. This price continued to the end of the year. Palladium started the year at $42 to $44 a fine ounce and had several reductions in price ending the year at $35 to $37 a fine ounce. Iridium also began the year with quotations $270 to $275 a fine ounce and like the two previous-mentioned had several reductions in price, ending the year at $200 to $210 a fine ounce.

Most of the platinum metals shipped to the United States during the year came from Colombia and South Africa.

[1] U. S. Bureau of Mines, Dept. of Commerce Press Bulletin, June 25, 1930.
[2] Engineering and Mining Journal, Vols. 127 and 128, 1929.

Platinum Production of California, by Years.

The annual production and values since 1887 have been as follows:

Year	Ounces	Value	Year	Ounces	Value
1887	100	$400	1909	416	$10,400
1888	500	2,000	1910	337	8,386
1889	500	2,000	1911	511	14,873
1890	600	2,500	1912	603	19,731
1891	100	500	1913	368	17,738
1892	80	440	1914	463	14,816
1893	75	517	1915	667	21,149
1894	100	600	1916	886	42,642
1895	150	900	1917	610	43,719
1896	162	944	1918	571	42,788
1897	150	900	1919	*418	60 611
1898	300	1,800	1920	477	68,977
1899	300	1,800	1921	613	58,754
1900	400	2,500	1922	795	90,288
1901	250	3,200	1923	602	78,546
1902	39	468	1924	273	36,452
1903	70	1,052	1925	292	39,937
1904	123	1,849	1926	322	32,005
1905	200	3,320	1927	139	10,749
1906	91	1,647	1928	312	27,902
1907	300	6,255	1929	212	14,416
1908	706	13,414	Totals	15,177	$803,885

* Fine ounces, beginning with 1919.

Red Elephant Quicksilver Mine in Lake County.

QUICKSILVER

Bibliography: State Mineralogist Reports IV, V, XII-XV, XVII-XXV (inc.). Bulletins 27, 78, 91. U. S. Geol. Surv., Monograph XIII. U. S. Bur. of Mines, Tech. Papers 96, 227; Bulletin 222.

The production of quicksilver for 1929 in California was 10,152 flasks (of 76 pounds avoirdupois) valued at $1,195,705. This was an increase both in quantity and value over the 1928 production, which was 7107 flasks (76 pounds) and $844,649. This production came

from Colusa, Fresno, Kern, Lake, Napa, Orange, San Benito, San Luis Obispo, Santa Clara, Siskiyou, Sonoma and Trinity counties.

During 1929 the average monthly quotations were over $122 with the highest in August with an average of $126 for a 76-pound flask. In June, 1927, the price quotations changed from a 75-pound flask to a 76-pound flask. The average price received during 1929 according to the producers' report to the Division of Mines was $117.78 per 76-pound flask, as compared to $118.84 received in 1928, which was also the highest record average.

The average quotation for quicksilver in 1929 was $123.97 for 76-pound flask at San Francisco compared with $125.00 for 76-pound flask in 1928, $117.25 (76-pound flask) in 1927 and $87.64 (75-pound flask) in 1926.

Distribution of the 1929 output of quicksilver by counties was as follows:

County	*Flasks*	*Value*
Lake	1,697	$203,247
Napa	2,081	246,747
San Luis Obispo	1,076	120,995
Colusa, Fresno, Kern, Orange, San Benito, Santa Clara, Siskiyou, Sonoma and Trinity*	5,298	624,696
Totals	10,152	$1,195,705

* Combined to conceal the output of a single operator in each.

The United States Bureau of Mines[1] reported the total production of the United States for 1929 at 23,682 flasks (76 pounds) valued at $2,892,638 (using $122 as the average of New York quotations). Outside of California, the principal yield came from Nevada, Oregon, Washington, Texas and Arizona. Californian production was approximately 44% of the total. The national production for 1928 was 17,870 (76-pound) flasks valued at $2,207,003.

The imported quicksilver in 1929 amounted to 14,292 flasks. Of this, 9412 flasks came from Spain, 1249 flasks from Belgium, 1209 flasks from Mexico, 892 flasks from Italy and 1530 from Germany, Canada, France and Peru.

The rise in price of quicksilver the last quarter of 1926 and during 1927 and 1928 was due to an increased demand in the United States for the metal. This was shown by the increased production and imports during these years coupled with a continued demand of continental Europe. In 1929 the high price still persisted, also the demand, as shown above by the increased domestic production, although there was a slight decline in imports.

Uses.

The most important uses of quicksilver are the recovery of gold and silver by amalgamation, and in the manufacture of fulminate for explosive caps, of drugs, of electrical appliances, of scientific apparatus, pigments and cosmetics. By far the greatest consumption is in the manufacture of fulminate and drugs. Radio tubes, Neon and mercury lights and electrical appliances are taking increasing amounts.

[1] U. S. Bureau of Mines, Dept. of Comm. Press Bull., June 21, 1930.

Total Quicksilver Production of California.

Total amount and value of the quicksilver production of California, as given in available records, are shown in the preceding tabulation. Though the New Almaden Mine in Santa Clara County was first worked in 1824, and has been in practically continuous operation since 1846 (the yield being small the first two years), there are no available data on the output earlier than 1850. Previous to June, 1904, a 'flask' of quicksilver contained 76½ pounds; then 75 pounds up to and including 1927; beginning with 1928, of 76 pounds. In compiling this table the following sources of information were used: for 1850–1883, table by J. B. Randol, in Report of State Mineralogist, IV, p. 336; 1883–1893, U. S. Geological Survey reports; 1894 to date, statistical bulletins of the State Mining Bureau; also State Mining Bureau, Bulletin 27, "Quicksilver Resources of California," 1908, p. 10.

Year	Flasks	Value	Average price per flask	Year	Flasks	Value	Average price per flask
1850	7,723	$768,052	$99 45	1891	22,904	$1,036,406	$45 25
1851	27,779	1,859,248	66 93	1892	27,993	1,139,595	40 71
1852	20,000	1,166,600	58 33	1893	30,164	1,108,527	36 75
1853	22,284	1,235,648	55 45	1894	30,416	934,000	30 70
1854	30,004	1,663,722	55 45	1895	36,104	1,337,131	37 04
1855	33,000	1,767,150	53 55	1896	30,765	1,075,449	34 96
1856	30,000	1,549,500	51 65	1897	26,691	993,445	37 28
1857	28,204	1,374,381	48 73	1898	31,092	1,188,626	38 23
1858	31,000	1,482,730	47 83	1899	29,454	1,405,045	47 70
1859	13,000	820,690	63 13	1900	26,317	1,182,786	44 94
1860	10,000	535,500	53 55	1901	26,720	1,285,014	48 46
1861	35,000	1,471,750	42 05	1902	29,552	1,276,524	43 20
1862	42,000	1,526,700	36 35	1903	32,094	1,335,954	42 25
1863	40,531	1,705,544	42 08	1904	[a] 28,376	1,086,323	37 62
1864	47,489	2,179,745	45 90	1905	24,655	886,081	35 94
1865	53,000	2,432,700	45 90	1906	19,516	712,334	36 50
1866	46,550	2,473,202	53 13	1907	17,379	663,178	38 16
1867	47,000	2,157,300	45 90	1908	18,039	763,520	42 33
1868	47,728	2,190,715	45 90	1909	16,217	773,788	47 71
1869	33,811	1,551,925	45 90	1910	17,665	799,002	45 23
1870	30,077	1,725,818	57 38	1911	19,109	879,205	46 01
1871	31,686	1,999,387	63 10	1912	20,600	866,024	42 04
1872	31,621	2,084,773	65 93	1913	15,661	630,042	40 23
1873	27,642	2,220,482	80 33	1914	11,373	557,846	49 05
1874	27,756	2,919,376	105 18	1915	14,199	1,157,449	81 52
1875	50,250	4,228,538	84 15	1916	21,427	2,003,425	93 50
1876	75,074	3,303,256	44 00	1917	24,382	2,396,466	98 29
1877	79,396	2,961,471	37 30	1918	22,621	2,579,472	114 03
1878	63,880	2,101,652	32 90	1919	15,200	1,353,381	89 04
1879	73,684	2,194,674	29 85	1920	10,278	775,527	75 45
1880	59,926	1,857,706	31 00	1921	3,157	140,666	44 56
1881	60,851	1,815,185	29 83	1922	3,466	191,851	55 35
1882	52,732	1,488,624	28 23	1923	5,458	332,851	60 98
1883	46,725	1,343,344	28 75	1924	7,948	543,080	68 33
1884	31,913	973,347	30 50	1925	7,683	621,831	80 81
1885	32,073	986,245	30 75	1926	5,892	516,382	87 64
1886	29,981	1,064,326	35 50	1927	6,488	714,418	111 67
1887	33,760	1,430,749	42 38	1928	[b] 7,107	844,649	118 84
1888	33,250	1,413,125	42 50	1929	10,152	1,195,705	117 78
1889	26,464	1,190,880	45 00				
1890	22,926	1,203,615	52 50	Totals	2,243,178	$111,802,273	

[a] Flasks of 75 lbs. since June, 1904; of 76½ lbs. previously.
[b] Flasks of 76 pounds, from January, 1928.

SILVER

Bibliography: State Mineralogist Reports IV, VIII, XII-XXVI (inc.). Bulletins 67, 91. Min. & Sci. Press, March 1, 1919.

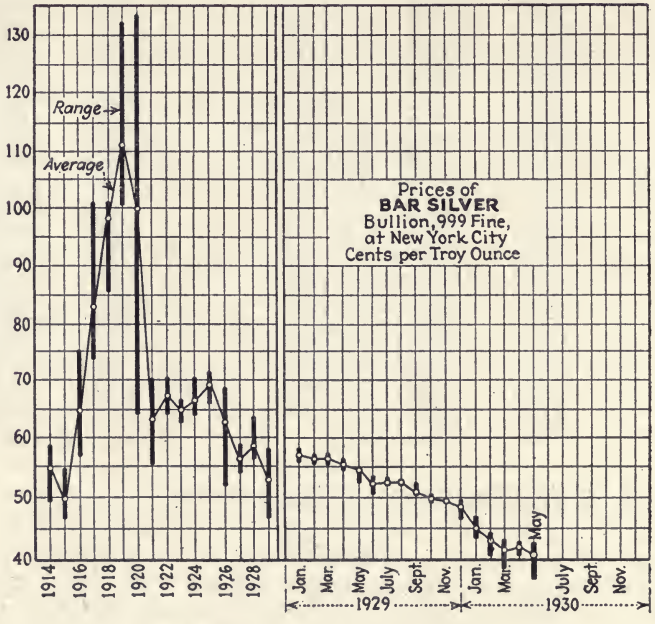
Except in the early-day production from the silver mines of the Calico district and the more recent production from those of the Rands-

burg area, both of which are in San Bernardino County, and the Calistoga district in Napa County, the recovery of silver in California has been largely as a by-product from its association with copper, lead, and gold ores.

The 1929 silver production of California totaled 1,176,895 fine ounces valued at $627,285, as compared with the 1928 production which was 1,478,771 fine ounces worth $865,081. Of the 1929 yield 13,312 fine ounces worth $7,095 came from placers. The average price of domestic silver during 1929 was 53.3 cents per ounce in New York compared with 58.5 cents in 1928 and 56.7 cents in 1927.

Distribution of the 1929 silver production by counties was as follows:

County	*Fine ounces*	*Value*	*County*	*Fine ounces*	*Value*
Alameda	104	$55	Nevada	41,015	$21,861
Amador	17,621	9,392	Orange	839	447
Butte	329	175	Placer	250	133
Calaveras	6,461	3,444	Plumas	408,466	217,712
Del Norte	6	3	Riverside	1,468	782
El Dorado	442	236	Sacramento	2,886	1,538
Fresno, Merced and Stanislaus	1,142	609	San Bernardino	356,015	189,756
Humboldt	189	101	San Diego	9	5
Imperial	30	16	San Luis Obispo	2	1
Inyo	43,544	23,209	Shasta	58,251	31,048
Kern	4,337	2,312	Sierra	3,345	1,783
Lassen	4	2	Siskiyou	1,619	863
Los Angeles	64	34	Trinity	19,266	10,269
Madera	891	475	Tuolumne	5,132	2,735
Mariposa	1,221	651	Ventura	6	3
Mono	52,791	28,138	Yuba	4,968	2,648
Monterey	2	1	Totals	1,176,895	$627,285
Napa	144,180	76,848			



From Eng. & Min. Jour., June, 1930.

The following paragraphs are quoted from the United States Bureau of Mines, Department of Commerce, Advanced Statement on Gold and Silver for 1929:

"The mine production of silver in California was 1,176,895 ounces, valued at $627,285, a decrease of 301,876 ounces in quantity and $237,796 in value compared with 1928. No company produced more than 500,000 ounces, only 4 more than 100,000 ounces, 2 between 50,000 and 100,000 ounces, and 26 each with less than 50,000 ounces. The chief silver-producing counties in 1929 were Plumas, San Bernardino, and Napa, ranging from a high of 408,466 ounces to a low of 144,180 ounces, followed by Shasta, Mono, and Inyo, each with an output of between 40,000 and 50,000 ounces. Of the total silver output from lode mines dry silver ore yielded slightly over 41 per cent, copper ore, tailings, etc., 47 per cent; the remainder came about equally from gold ore and tailings and lead ore, with a small amount from lead-copper ore. The yield of silver from placer mines was 13,312 ounces, valued at $7,095."

Mill of Banner Development Co. (Palisade Mine), near Calistoga, Napa County.

Silver Production of California, by Years.

The amount and value of the silver production of California, and the average price, annually, since 1880 are given in the table following. In the table shown in the statistical bulletins previous to Bulletin 97 (for 1925), the value shown for 1880-1904 (inc.) were taken from the reports of the Director of the Mint, of which the figures for 1880-1896 (inc.) were based on 'coinage value' ($1.2929 per fine ounce). We have recalculated these to commercial value, using the price table of the U. S. Geological Survey (McCaskey, H. D., Gold and Silver, 1913: Mineral Resources of the U. S., Part I, p. 847). From 1905 to date, the figures are those of the U. S. Geological Survey and its successor, the U. S. Bureau of Mines:

Silver Production of California, by Years, Since 1880

Year	Fine oz.	Value	Average price per oz.	Year	Fine oz.	Value	Average price per oz.
1880	882,169	$1,014,494	$1 15	1906	1,220,641	$817,830	$0 68
1881	580,091	655,503	1 13	1907	1,138,856	751,646	66
1882	653,569	745,069	1 14	1908	1,647,278	873,057	53
1883	1,129,244	1,253,461	1 11	1909	2,098,253	1,091,092	52
1884	3,236,987	3,593,056	1 11	1910	1,840,085	993,646	54
1885	1,986,260	2,125,298	1 07	1911	1,270,445	673,336	53
1886	1,245,747	1,233,290	0 99	1912	1,300,136	799,584	615
1887	1,262,282	1,237,036	0 98	1913	1,378,399	832,553	604
1888	1,314,874	1,235,982	0 94	1914	1,471,859	813,938	553
1889	823,947	774,510	0 94	1915	1,678,756	851,129	507
1890	820,336	861,353	1 05	1916	2,564,354	1,687,345	658
1891	737,224	729,852	0 99	1917	1,775,431	1,462,955	824
1892	358,575	311,960	87	1918	1,427,711	1,427,711	1 00
1893	415,468	324,065	78	1919	1,107,189	1,240,051	1 12
1894	229,896	144,834	63	1920	1,706,327	1,859,896	1 09
1895	463,911	301,542	65	1921	3,629,223	3,629,223	1 00
1896	326,757	222,195	68	1922	3,100,065	3,100,065	1 00
1897	754,648	452,789	60	1923	3,559,443	2,918,743	82
1898	701,788	414,055	59	1924	3,555,133	2,381,952	67
1899	855,869	513,521	60	1925	3,054,416	2,119,765	694
1900	1,168,157	724,257	62	1926	2,022,460	1,262,015	624
1901	950,831	570,499	60	1927	1,620,242	918,677	567
1902	1,163,041	616,412	53	1928	1,478,771	865,081	585
1903	958,230	517,444	54	1929	1,176,895	627,285	533
1904	1,441,259	835,929	58				
1905	1,076,174	650,009	0 61	Totals	72,359,702	$56,056,990	

TIN

Bibliography: Reports XV, XVII, XVIII, XXV. Bulletins 67, 91.

In 1928 and 1929 there was a small amount of tin produced from Californian ore as well as considerable development work which was done at the Temescal mine in Riverside County near Corona.

There was an output from the district during 1891–1892 as tabulated below. Small quantities of stream tin have been found in some of the placer workings in northern California, but never in paying amounts.

Two occurrences have also been noted, in northern San Diego County. Crystals of cassiterite were found there, associated with blue tourmaline crystals, amblygonite and beryl. No commercial quantity has been developed, only small pockets have been taken out.

On March 12, 1929, the new tin plating plant of the Columbia Steel Corporation at Pittsburg, Contra Costa County, California, started operation. This is the first tin plate mill west of St. Louis. This mill will have an annual capacity of 38,000 tons of tin plate per year and will give the Pacific Coast a local source for their tin plate.

The principal sources of the world's supply of tin are the islands of Banka, Billiton and Singkep, Netherlands India (Dutch East Indies), followed by the Federated Malay States (Perak, Pahang, Negri Sembilan and Selangor). Bolivia, Siam, Cornwall, Transvaal, New South Wales, Queensland and Tasmania are also important sources. A measurable amount of the metal is also recovered by detinning scrap and old cans.

Total Output of Tin in California

Year	*Pounds*	*Value*
1891	125,289	$27,564
1892	126,000	32,400
1928 }	*	*
1929 }		
Totals	251,289	$59,964

* Annual details concealed under 'Unapportioned.'

TITANIUM

Bibliography: State Mineralogist's Report XXIII.

During 1929 there was no production of titanium ores in California. In 1927 the first recorded shipments of titanium minerals were made in California. The total of the 1927 and 1928 production was 10,013 tons valued at $150,195. All of this came from Los Angeles County and was produced from either the black beach sands, which probably contained approximately 20% titaniferous iron and magnetite, the gangue being silica and several silicates, or from a lode deposit in the San Gabriel Mountains.

Titanium is widely distributed in a variety of minerals, but its commercial sources are limited to three forms, rutile (oxide), ilmenite (titanite), and titaniferous magnetite (iron ore rich in titanium). There are several known areas where large deposits of these minerals are found in America, mostly titaniferous iron. Of the titaniferous iron deposits only a portion of the Adirondack deposit, some small deposits in North and South Carolina, and those in Los Angeles County are capable of being separated into a high-grade ilmenite and a low titanium magnetite.

The metal is used in several different alloys with iron, copper and aluminum and for green and white paint pigments, the only colors of titanium pigments now in common use. It is also used in dyes, rubber, as a porcelain glaze, in glass, and cement made from high-titanium iron slags. This cement is resistant to the action of acids.

The market price of titanium minerals varies as to the titanium oxide it contains. Rutile 94% TiO at 10¢ a pound, ilmenite 45 to 52% TiO at $10 to $12 a ton, and ilmenite 32 to 35% TiO at $7 to $8 a ton, all prices Atlantic seaboard.

TUNGSTEN

Bibliography: Reports XV, XVII, XVIII, XXII, XXIV, XXV. Bulletins 38, 67, 91, 95. U. S. G. S. Bull. 652. Proc. Colo. Sci. Soc. Vol. XI, South Dakota School of Mines, Bulletin No. 12. Eng. and Min. Jour.-Press, Vol. 113, pp. 666–6669, Apr. 22, 1922.

The commercial production of tungsten ores and concentrates in California began in 1905; and has been continuous since, with the exception of 1920-1922 (inclusive), when the mines were shut down owing to low prices due to excess stocks following the war and to lack of tariff protection against foreign importations. Production was resumed on a small scale late in 1923, and is now at practically its pre-war average annual tonnage, though the 1929 figures are less than those for 1928. The material shipped in 1929 included both high-grade sorted ore and concentrates, coming from properties in Inyo, Kern, and San Bernardino counties. A total of 142 tons were reported produced yielding 150 tons recalculated to 60% WO_3, valued at a total of $106,280.

Quotations[1] during 1929 ranged from $11.75 to $18 per unit of WO_3, duty paid, for Chineses wolframite while domestic scheelite ranged from

[1] Engineering and Mining Journal, Vol. 127 and 128.

$12 to $18.50 a unit. The present prices are per unit WO_3, New York, wolframite $12.50 to $13, and domestic scheelite $14.

Tungsten ore has been produced in California principally in the Atolia-Randsburg district in San Bernardino and Kern counties, followed by the Bishop district in Inyo County, with small amounts coming from Nevada County and from the district near Goffs, in eastern San Bernardino. Most of the California tungsten ore is scheelite (calcium tungstate), though wolframite (iron-manganese tungstate) and hübernite (manganese tungstate) also occur. The deposits at Atolia are the largest and most productive scheelite deposits known,[1] and the output has in some years equaled or exceeded that of ferberite (iron tungstate) from Boulder County, Colorado. It is interesting in this connection to note that, in practically all other tungsten producing districts of the world, wolframite is the important constituent.

Imports of foreign tungsten ore and alloys into the United States during 1929 amounted to 6,809,965 pounds valued at $2,510,270 compared with 2,729,508 pounds valued at $573,307 in 1928 and 10,362 long tons of ore valued at $11,409,237 in 1918, which ores were duty free up to September 22, 1922. Owing to lack of protection against the cheap coolie labor of Asiatic tungsten mines and low market prices, practically all of the tungsten mines in the United States were closed down from the middle of 1919 to the latter part of 1923. Quotations during 1922 ranged around $2.50 per unit, up to September of that year when the tariff was placed on the ore. The Tariff Act of 1930 raised the duty on tungsten ore or concentrates to 50 cents per pound on the metallic tungsten contained therein. Duties are also provided for imported tungsten-bearing alloys. Most of the imported ore is coming from China, with smaller amounts from Malaya and Bolivia.

Uses.

The metal, tungsten, is used mainly in the steel industry and in the manufacture of electrical appliances, including the well-known tungsten filament lamps. Because of its resistance to corrosion by acids, it is valuable in making certain forms of chemical apparatus. Its employment in tool-steel alloys permits the operation of cutting tools, such as in lathe work, at a speed and temperature at which carbon steel would lose its temper—hence the name 'high speed' steels for these tungsten alloys. As made in the United States, tungsten forms 13% to 20% of such steels. Some chromium, nickel, cobalt, or vanadium are sometimes also included. Tungsten compounds are used in the manufacture of colors. The indicated consumption is approximately 5000 tons of 60% concentrates per year, in the United States.

Tungsten is introduced into the molten steel charge, either as the powdered metal or as ferro-tungsten (containing 50%–85% tungsten). The specific gravity of the pure metal, 19.3–21.4, is exceeded only by platinum, 21.5; iridium, 22.4; and osmium, 22.5. Its melting point is 3267° C. (5913° F.), being higher than any other known metal. Though millons of tungsten filament lamps are now made, the wires are so fine that the metal they contain represents but a few tons of tungsten concentrates annually.

[1] U. S. G. S. Bull. 652, p. 32.

Total Tungsten Ore Production of California.

The annual amount and value of tungsten ores and concentrates produced in California since the inception of the industry is given herewith, with tonnages recalculated to 60% WO_3:

Year	Tons at 60% WO_3	Value	Year	Tons at 60% WO_3	Value
1905	57	$18,800	1918	1,982	$2,832,222
1906	485	189,100	1919	214	219,316
1907	287	120,537	1920		
1908	105	37,750	1923	34	19,126
1909	577	190,500	1924	781	446,009
1910	457	208,245	1925	573	348,475
1911	387	127,706	1926	441	316,560
1912	572	206,000	1927		
1913	559	234,673	1928	398	429,237
1914	420	180,575	1929	150	106,280
1915	962	1,005,467			
1916	2,270	4,571,521	Totals	14,177	$14,887,158
1917	2 466	3,079,013			

* Annual details concealed under 'Unapportioned.'

VANADIUM

Bibliography: Report XV. Bulletins 67, 91. Proc. Colo. Sci. Soc., Vol. XI. U. S. Bur. of Mines, Bulletin 104.

No commercial production of vanadium has yet been made in California. Occurrences of this metal have been found at Camp Signal, near Goffs, in San Bernardino County, and two companies at one time did considerable development work in the endeavor to open up paying quantities. Each had a mill under construction in 1916, but apparently no commercial output was made. Ore carrying the mineral cuprodescloizite and reported as assaying 4% V_2O_5 was opened up. Some ore carrying lead vanadate has been developed in the 29 Palms, or Washington district, on the line between Riverside and San Bernardino counties, but no shipments reported.

The principal use of vanadium is as an alloy in steels, especially in tool steel, and in those varieties where resistance to repeated strains is required. Present New York quotations for ferrovanadium are $3.16–$3.50 per pound of vanadium f. o. b. works, and vanadium ore 28¢ per pound V_2O_5 contained.

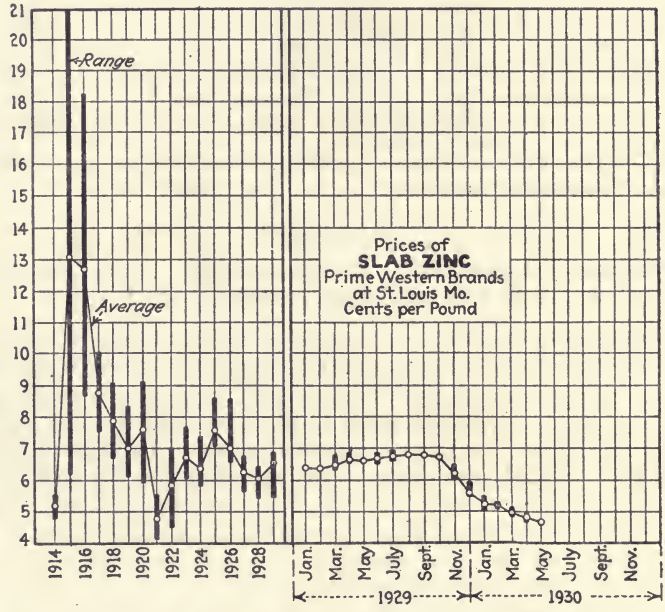
ZINC

Bibliography: State Mineralogist Reports XIV, XV, XVII, XVIII, XX-XXIV, Bulletins 38, 67, 91.

There was no recorded production of zinc ores in California during 1929. Owing to the low price of zinc and the distance required to ship the concentrates to a smelter, it is not profitable to smelt the ore at present. During the past few years most of California's zinc concentrates have been shipped to Belgium for smelting, although a small amount has been made into zinc oxide here in the state. The American zinc smelters are located along the Mississippi River or on eastern seaboard, with electrolytic zinc plants in both Idaho and Montana.

The zinc ores of Shasta and Calaveras counties are associated with copper, while those of Inyo, Los Angeles and San Bernardino are associated principally with lead-silver and zinc-silver ores.

The principal uses of zinc are for 'galvanizing' (plating on iron to prevent rust), for zinc oxide (used in rubber goods and paint), and for brass (an alloy of copper and zinc). These outlets for the metal take approximately 80% of the quantity produced. Of the remaining 20% a large portion is rolled into plates and sheets and utilized in the building industry for sheathing, roofing, leaders, and eaves-troughs. Zinc is particularly desirable and efficient for roofing and siding where corrosive gases are present, as at smelters, refineries and chemical plants.



From Eng. & Min. Jour., June 23, 1930.

Zinc Production of the United States.

The production of slab zinc[1] at reduction plants in the United States in 1929 amounted to 671,868 short tons at $88,687,000, not including 13,311 tons of primary metal made from foreign ores, mostly from Mexico, and reduced in refineries in this country, and 47,348 tons of redistilled secondary metal. The 1929 production was an increase from that of 1928 which was 651,247 tons for United States only.

The average price per pound quoted for the metal in 1929 was 6.5¢ as against 6.03¢ in 1928.

[1] U. S. Bureau of Mines, Department of Commerce. Press Bulletin May 23, 1930.

Total Zinc Production of California.

Total figures for zinc output of the state are as follows, commercial production dating back only to 1906:

Year	Pounds	Value	Year	Pounds	Value
1906	206,000	$12,566	1919	1,384,192	$101,046
1907	177,759	10,598	1920	1,188,009	96,229
1908	54,000	3,544	1921	846,184	42,309
1909			1922	3,034,430	172,963
1910			1923		
1911	2,679,842	152,751	1924	3,060,000	198,900
1912	4,331,391	298,866	1925	11,546,602	877,542
1913	1,157,947	64,845	1926	20,447,559	1,533,568
1914	399,641	20,381	1927	8,625,004	552,000
1915	13,043,411	1,617,383	1928		
1916	15,950,565	2,137,375	1929		
1917	11,854,804	1,209,190			
1918	5,565,516	506,466	Totals	105,552,901	$9,608,522

CHAPTER FOUR

STRUCTURAL MATERIALS

Bibliography: State Mineralogist Reports XII–XXVI (inc.). Bulletin 38. Spurr and Wormser, "Marketing of Metals and Minerals." "Non-Metallic Minerals," by R. B. Ladoo. See also under each substance.

As indicated by this subdivision heading, the mineral substances herein considered are those more or less directly used in building and structural work. California is independent, so far as these are concerned, and almost any reasonable construction can be made with materials produced in the state. This branch of the mineral industry for 1929 was valued at $46,759,148 as compared with a total value of $49,509,386 for the year 1928, the decline being mainly due to cement and in a smaller way to brick and hollow building-tile, lime, and magnesite; although both granite and miscellaneous stone showed substantial increases.

The 1927 output established a record for this type of material in both quantity and total value which was $54,861,649, exceeding all other years in total value records.

Crushed rock production is yearly becoming more worthy of consideration, due to the strides taken in the use of concrete, as well as to activity in the building of good roads. Brick, with an average annual output for a number of years worth approximately $2,000,000, had difficulty in holding its own, due to the popularity of cement and concrete. In 1920, however, the sales increased to nearly double the previous record figure of the year 1907, and in 1923 showed advances to new figures, with a slight recession in 1924–1929. This item will, no doubt, continue to be an important one, and a market for fire and fancy brick of all kinds will unquestionably never be lacking.

In 1929 all counties, with the exception of Kings and Sutter, contributed to this structural total. There is not a county in the fifty-eight counties of the state which is not capable of producing at least one of the materials under the classification and in 1926 every county contributed one or more substances to the group.

During 1929 building conditions in California continued downward in a survey[1] made covering 51 counties in the state. In these counties building permits showed an average decline of approximately 9 per cent from the previous year and 31 per cent from an average of the preceding six years (1923 to 1928). Twenty counties showed increases in building permits and 31 showed decreases. Contracts for heavy engineering construction have increased as well as for highway construction.

[1] California State Chamber of Commerce, Economic Survey Reports No. 28 and No. 33.

The following summary shows the value of the structural materials produced in California during the years 1928–1929, with increase or decrease in each instance:

Substance	1928		1929		+Increase —decrease value
	Amount	Value	Amount	Value	
Bituminous rock	4,966 tons	$33,832	3,320 tons	$14,360	—$19,472
Brick and hollow tile		5,694,770		5,607,410	—87,360
Cement	13,625,231 bbls.	24,463,287	12,794,729 bbls.	21,038,565	—3,424,722
Chromite	729 tons	15,179	327 tons	5,025	—10,154
Granite		763,996		1,169,271	+405,275
Lime	56,616 tons	547,919	42,834 tons	417,101	—130,818
Magnesite	45,645 tons	501,590	47,269 tons	488,014	—13,576
Marble[a]		82,190		93,661	+11,471
Sandstone	134,100 cu. ft.	43,250	177,655 cu. ft.	49,881	+6,631
Slate		31,263	*	*	*+
Stone, miscellaneous		17,332,110		17,840,159	+508,049
Unapportioned				[b]35,701	35,701
Total value		$49,509,386		$46,759,148	
Net decrease					—$2,750,238

*Under 'Unapportioned.'
[a]Includes onyx and travertine.
[b]Includes slate and tube mill pebbles.

ASPHALT

Bibliography: State Mineralogist Reports VII, X, XII–XV (inc.), XVII, XVIII. Bulletins 16, 32, 63, 67, 69, 91.

Asphalt was for a number of years accounted for in the statistical reports by the State Mining Bureau, because in the early days of the oil industry, considerable asphalt was produced from outcroppings of oil sand, and was a separate industry from the production of oil itself. However, at the present time most of the asphalt comes from the oil refineries, which produce a better and more uniform grade; hence, its value is not now included in the mineral total, as to do so would be in part a duplication of the crude petroleum figures. Such natural asphalt as is at present mined is in the form of bituminous sandstones, and is recorded under that designation.

BITUMINOUS ROCK

Bibliography: State Mineralogist Reports XII, XIII, XV, XVII, XVIII, XXI, XXII, XXV.

This material is essentially an uncemented sandstone which is saturated with and held together by a natural asphaltic constituent, probably the residue from the evaporation of a crude petroleum deposit. Bituminous rock is still used to a limited extent for road dressing in those districts adjacent to available deposits, though the manufacture of asphalt at the oil refineries has almost entirely superseded the direct use of the native material. Some of the Santa Cruz County production is put on the market as a material which can be laid cold. This material is especially applicable and valuable for patch jobs.

Shipments from quarries in Santa Barbara and Sant Cruz counties in 1929 totaled 3320 tons of bituminous rock valued at $14,360 f.o.b. railroad. This was a decrease both in quantity and value from the 1928 production which was 4966 tons valued at $33,832.

Bituminous Rock Production of California, by Years.

The following tabulation shows the total amount and value of bituminous rock quarried and sold in California, from the records compiled by the State Mining Bureau, annually since 1887:

Year	Tons	Value	Year	Tons	Value
1887	36,000	$160,000	1910	87,547	$165,711
1888	50,000	257,000	1911	75,125	117,279
1889	40,000	170,000	1912	44,073	87,467
1890	40,000	170,000	1913	37,541	78,479
1891	39,962	154,164	1914	66,119	166,618
1892	24,000	72,000	1915	17,789	61,468
1893	32,000	192,036	1916	19,449	66,561
1894	31,214	115,193	1917	5,590	18,580
1895	38,921	121,586	1918	2,561	9,067
1896	49,456	122,500	1919	4,614	18,537
1897	45,470	128,173	1920	5,450	27,825
1898	46,836	137,575	1921	8,298	43,192
1899	40,321	116,097	1922	4,624	13,570
1900	25,306	71,495	1923	2,945	11,780
1901	24,052	66,354	1924	6,040	14,922
1902	33,490	43,411	1925	2,681	10,724
1903	21,944	53,106	1926	3,863	21,577
1904	45,280	175,680	1927	3,515	17,704
1905	24,753	60,436	1928	4,966	33,832
1906	16,077	45,204	1929	3,320	14,360
1907	24,122	72,835			
1908	30,718	109,818	Totals	1,200,155	$3,730,352
1909	34,123	116,436			

BRICK AND HOLLOW TILE

Bibliography: State Mineralogist Reports VIII, X, XII–XV (inc.), XVII–XXIII (inc.). Bulletins 38, 99. Preliminary Report, No. 7. Cal. Jour. of Development, June, 1925, pp. 5–6.

Bricks of many varieties and in important quantities are annually produced in California, as might be expected in a state with such diversified and widespread mineral resources. The varieties include common, fire, pressed, glazed, enamel, fancy, vitrified, sand-lime, and others. Not only do the plants here supply practically all of our own requirements in these products, but considerable quantities are shipped to contiguous territory and certain products are shipped over a much wider radius. So far as possible, the different kinds have been segregated in the tabulation herewith accompanying.

We also include under this heading the various forms of hollow building 'tile' or blocks. The application of these tile to residence construction as well as to other structures is growing; though their total for 1929 shows an increase from the figures of 1928.

The aggregate value of all kinds of brick in 1929 shows an increase approximately 6 per cent from that of 1928, although the fire-brick group was the only one showing an increase that was substantial enough to offset the decrease registered by other groups.

Bulletin No. 99, "The Clay Resources and the Ceramic Industry of California," published 1928, covers all the brick plants throughout the state, giving a detailed description of each.

The detailed figures of brick and tile production for 1929, by counties, are shown in the following tabulation:

BRICK AND HOLLOW TILE PRODUCTION FOR 1929, BY COUNTIES

County	Common		Fire		Glazed, pressed, fancy, vitrified paving		Hollow building tile or blocks		Total value
	Amount	Value	Amount	Value	Amount	Value	Tons	Value	
Kern	3,503	$44,681							$44,681
Los Angeles	183,882	1,529,202	11,279	$721,380	4,099	$223,093	18,698	$281,695	2,755,370
Orange	774	7,743							7,743
Riverside	*		7,408	224,307	5,082	195,864	10,195	82,679	502,850
Sacramento	11,927	174,902			*		*		174,902
San Diego	8,453	86,405	*		*		6,541	50,872	137,277
San Joaquin	6,749	91,679	*				*		91,679
San Luis Obispo	1,735	24,790					*		24,790
Santa Clara	14,063	168,872							168,872
Ventura	5,965	71,875					*		71,875
Alameda, Amador, Butte, Contra Costa, Fresno, Humboldt, Marin, Mendocino, Merced, Riverside, Santa Barbara, Tulare*	41,283	487,514							487,514
Alameda, Amador, Fresno, Merced, Placer, San Diego, San Joaquin*			13,651	748,752					748,752
Alameda, Contra Costa, Fresno, Merced, Placer, Sacramento, San Diego*					7,158	224,790			224,790
Alameda, Contra Costa, Fresno, Merced, Placer, Sacramento, San Joaquin, San Luis Obispo, Santa Barbara, Ventura*							31,279	166,315	166,315
Totals	278,334	$2,687,663	32,338	$1,694,439	16,339	$643,747	66,713	$581,561	$5,607,410

*Combined to conceal the output of a single operator in each.

Brick and Hollow Tile Production of California, by Years.

Record of brick production in the state has been kept since 1893 by this Bureau, the figures for hollow building 'tile' or blocks being also included since 1914. The annual and total figures, for amount and value, are given in the following table:

Year	Brick, M	Hollow building blocks, tons	Value
1893	103,900	------	$801,750
1894	81,675	------	457,125
1895	131,772	------	672,360
1896	24,000	------	524,740
1897	97,468	------	563,240
1898	100,102	------	571,362
1899	125,950	------	754,730
1900	137,191	------	905,210
1901	130,766	------	860,488
1902	169,851	------	1,306,215
1903	214,403	------	1,999,546
1904	281,750	------	1,994,740
1905	286,618	------	2,273,786
1906	277,762	------	2,538,848
1907	362,167	------	3,438,951
1908	332,872	------	2,506,495
1909	333,846	------	3,059,929
1910	340,883	------	2,934,731
1911	327,474	------	2,638,121
1912	337,233	------	2,940,290
1913	358,754	------	2,915,350
1914	270,791	------	2,288,227
1915	180,538	------	1,678,756
1916	206,960	------	2,096,570
1917	192,269	29,348	2,532,721
1918	136,374	34,818	2,363,481
1919	156,328	36,026	3,087,067
1920	245,842	99,208	5,704,393
1921	238,022	67,100	5,570,875
1922	374,853	105,909	7,994,991
1923	397,754	122,534	9,738,082
1924	456,716	114,469	9,137,908
1925	361,094	105,491	7,503,976
1926	388,048	90,332	7,026,124
1927	374,111	75,116	6,516,077
1928	272,443	66,277	5,694,770
1929	327,011	66,713	5,607,410
Totals	9,135,591	1,013,341	$121,199,435

CEMENT

Bibliography: State Mineralogist Reports VIII, IX, XII, XIV, XV, XVII, XVIII, XXI–XXV (inc.). Bulletin 38.

Cement is the most important single structural material in the mineral output of California. During 1929 there was a total of 12,794,729 barrels valued at $21,038,565 f.o.b. plant, being a decrease in both quantity and value. The 1928 output was 13,625,231 barrels valued at $24,463,287, or an average of $1.79 per barrel. The 1929 average value was $1.64 per barrel.

The 1929 production came from eleven operating plants in nine counties and employing a total of 2220 men. Three plants in San Bernardino County made a total of 3,576,005 barrels valued at $4,603,301, the balance of the state's production coming from a single plant in each of the following counties: Calaveras, Contra Costa, Kern, Merced, Riverside, San Benito, San Mateo, and Santa Cruz.

There has been an interesting parallelism in the growth of the Portland cement and the crushed rock, sand and gravel industries in California. The use of concrete has been a most important development in structural work during the last 20 or 30 years, and has made possible

the building of such great monolithic structures as our irrigation and hydro-electric power dams, as well as highway pavements and sky-scraper office buildings.

Cement Production of California, by Years.

'Portland' cement was first commercially produced in California in 1891; though in 1860 and for several years following, a natural hydraulic cement from Benicia was utilized in building operations in San Francisco.

"The Benicia Cement Company in 1859–60 was turning out 50 to 100 barrels of cement a day and San Francisco was using about 12,000 barrels a year. The mill price of the product was then $4 a barrel. By 1865, the San Francisco rate of consumption had increased to 100,000 barrels yearly, brick buildings largely taking the place of frame structures, and the price of cement had fallen to $2.50 a barrel, about the same as it is today."[1]

The growth of the industry became rapid after 1902; since which time cement has continued to be an important factor in the industrial life of the state. Although the total cement figures, to date, are not of the same magnitude as those for gold and petroleum, it is interesting to note that the value of California's cement yield beginning with 1920 has since annually exceeded the value of her gold output.

Annual production of cement in California has been as follows:

Cement Production of California, by Years

Year	Barrels	Value	Year	Barrels	Value
1891	5,000	$15,000	1912	6,198,634	$6,074,661
1892	5,000	15,000	1913	6,167,806	7,743,024
1893			1914	5,109,218	6,558,148
1894	8,000	21,600	1915	4,918,275	6,044,950
1895	16,383	32,556	1916	5,299,507	6,210,293
1896	9,500	28,250	1917	5,790,734	7,544,282
1897	18,000	66,000	1918	4,772,921	7,969,909
1898	50,000	150,000	1919	4,645,289	8,591,990
1899	60,000	180,000	1920	6,709,160	14,962,945
1900	52,000	121,000	1921	7,404,221	18,072,120
1901	71,800	159,842	1922	8,962,135	16,524,056
1902	171,000	423,600	1923	10,825,405	25,999,203
1903	640,868	968,727	1924	11,655,131	23,225,850
1904	969,538	1,539,807	1925	13,206,630	25,043,335
1905	1,265,553	1,791,916	1926	13,797,173	25,269,678
1906	1,286,000	1,941,250	1927	14,661,783	26,474,935
1907	1,613,563	2,585,577	1928	13,625,231	24,463,287
1908	1,629,615	2,359,692	1929	12,794,729	21,038,565
1909	3,779,205	4,969,437			
1910	5,453,193	7,485,715	Totals	180,019,569	$311,751,815
1911	6,371,369	9,085,625			

CHROMITE

Bibliography: State Mineralogist Reports IV, XII, XIII, XIV, XV, XVII, XVIII, XXI–XXV (inc.). Bulletins 38, 76, 91. Preliminary Report 3. U. S. G. S., Bull. 430. Min. & Sci. Press, Vol. 114, p. 552.

Chrome iron ore or chromite to the amount of 327 short tons recalculated to the basis of 45% Cr_2O_3, valued at $5,025 f.o.b. shipping point, was sold in California during 1929. This was a decrease from the

[1] Monthly Review of Mercantile Trust Co. of Cal., Vol. XIII, No. 3, p. 55, Mar., 1924.

1928 production which was 729 tons, valued at $15,179. This material came from San Luis Obispo, Shasta, Sonoma, Tehama and Trinity counties with a single operator in each. The grade varied from 37% to 50% Cr_2O_3. About half of the above material was mined during the year, the remainder having been mined during the World War period but not sold then.

It is hoped that the development of the steel industry and the resumption of copper smelting on the Pacific Coast may create some demand for California's chromite, but the outlook for the immediate future is not encouraging.

The political and commercial control of chromite now rests largely with England, through the ownership and sales contracts exercised by the Chrome Company (Ltd.), of London. That company controls both the Rhodesian and the New Caledonian output.

Occurrence.

Until 1916, when some shipments were made from Oregon and smaller amounts from Maryland, Wyoming and Washington, practically our only domestic production of chromite for many years came from California. From 1830 to 1870 the deposits in Maryland supplied the world's consumption.

Chromite is widely distributed in California, the principal production, thus far, having come from El Dorado, San Luis Obispo, Del Norte, Shasta, Siskiyou, Placer, Fresno, and Tuolumne counties. In 1918 a total of 29 counties contributed to the state's output. There are two main belts in California yielding this mineral, one along the Coast Ranges from San Luis Obispo County to the Oregon line, including the Klamath Mountains at the north end, and the other in the Sierra Nevada from Tulare County to Plumas County. Chromite occurs as lenses in basic igneous rocks such as peridotite and pyroxenite, and in serpentines which have been derived by alteration of such basic rocks. For the most part, so far as developments have yet shown, the lenses have proved to be small, relatively few of them yielding over 100 tons apiece. A notable exception to this was the deposit on Little Castle Creek, near Dunsmuir, from which upwards of 15,000 tons were shipped before it was exhausted. Deposits worked in Del Norte County during 1918 promise well for a large tonnage. On the whole the orebodies in the northwestern corner of the state appear to average larger in size than the chromite lenses in other parts of California.

Concentration became an accomplished fact in several localities, thus utilizing some of the disseminated and lower-grade orebodies which have been found. In fact, an important part of the 1918–1920 production of California came from that source.

Imports.

Importations of foreign chromite duty free, mainly from Rhodesia, New Caledonia and India, totaled 345,990 long tons in 1929, valued at $2,666,488, compared with 216,592 long tons, worth $1,704,988 in 1928.

Uses.

The major consumption of chromite ore is for use as a refractory lining in smelting furnaces for steel and copper. A smaller portion

is used in the preparation of ferrochrome for chrome-steel alloys, and of chromium chemicals, the latest development of which is chrome plating as used in the automobile industry, on ships, and in oil refineries to protect metal surfaces from wear and erosion. It is stated that during the last five years, the sales of chromite brick and chromite cement have increased 500%, because of their replacing magnesite which is more expensive.

Total Chromite Production of California.

Production of chromite in California began, apparently, about 1874, principally in San Luis Obispo County. There was considerable activity from 1880 to 1883, inclusive, and a total of 23,238 long tons (or 26,028 short tons), valued at $329,924 was shipped from that county up to the beginning of 1887. Some ore also was shipped from the Tyson properties in Del Norte County. The tabulation herewith shows the output of chromite in California, annually, including the earliest figures so far as they are available. The figures from 1887 to date are from the records of the State Mining Bureau:

Total Chromite Production of California

Year	Tons	Value	Year	Tons	Value
1874–1876 (San Luis Obispo County)	26,028	$329,924	1909	436	$5,309
1887	3,000	40,000	1910	749	9,707
1888	1,500	20,000	1911	935	14,197
1889	2,000	30,000	1912	1,270	11,260
1890	3,599	53,985	1913	1,180	12,700
1891	1,372	20,580	1914	1,517	9,434
1892	1,500	22,500	1915	3,725	38,044
1893	3,319	49,785	1916	48,943	717,244
1894	3,680	39,980	1917	52,379	1,130,298
1895	1,740	16,795	1918	73,955	3,649,497
1896	786	7,775	1919	*4,314	97,164
1897			1920	1,770	43,031
1898			1921	347	6,870
1899			1922	379	6,334
1900	140	1,400	1923	84	1,658
1901	130	1,950	1924	350	6,700
1902	315	4,725	1925	191	3,712
1903	150	2,250	1926	393	7,063
1904	123	1,845	1927	225	5,063
1905	40	600	1928	729	15,179
1906	317	2,859	1929	327	5,025
1907	302	6,040	Totals	244,591	$6,455,227
1908	350	6,195			

* Recalculated to 45% Cr_2O_3, beginning with 1919.

GRANITE

Bibliography: State Mineralogist Reports X, XII–XXV (inc.). Bulletin 38.

The value of the granite output in California during 1929 was worth $1,169,271 (this included a small amount of tuff, and some flow volcanic rocks which were used as flagstone), and was an increase from the 1928 value which was $763,996.

So far as possible, granite production has been segregated in the table herewith into the various uses to which the product was put. It will be noted, however, that a portion of the output has been entered under the heading 'Unclassified.' This is necessary because of the fact that some of the producers have no way of telling to what specific use

their stone was put after they had quarried and sold the same in the rough.

Varieties.

For building purposes, the granites found in California, particularly the varieties from Raymond in Madera County, Rocklin in Placer County, and near Porterville in Tulare County, are unexcelled by any similar stone found elsewhere. The quantities available, notably at Raymond and Porterville, are unlimited. Most of California's 'granite,' particularly that found in the Sierra Nevada Mountains, is technically 'granodiorite' (that is, both plagioclase and orthoclase feldspars are present).

Granites of excellent quality for building and ornamental purposes are also quarried in Riverside and San Diego counties. Near Lakeside, San Diego County, there is a fine-grained, 'silver gray' granite of uniform texture and color, especially suited for monumental and ornamental work.

The Fresno County stone is a dark, hornblende diorite, locally called 'black granite,' whose color permits of a fine contrast of polished and unpolished surfaces. making it particularly suitable for monumental and decorative purposes. There is also a similar 'black granite' in Tulare County, near Success.

GRANITE PRODUCERS, BY COUNTIES, FOR 1929

County	Building stone		Monumental		Curbing		Unclassified		Total value
	Cubic feet	Value	Cubic feet	Value	Linear feet	Value	Cubic feet	Value	
Fresno			16,056	$28,000					$28,000
Placer	*		4,744	7,401	*		3,868	$5,770	13,171
San Diego	*		15,059	28,088					28,088
Inyo,[2] Madera, Placer, Riverside, Sacramento, San Diego, San Luis Obispo,[2] Tulare*	615,936	$769,788							769,788
Lassen, Madera, Nevada, Plumas, Sacramento, Tulare*			161,060	310,608					310,608
Nevada, Placer*					1,130	$3,116			3,116
Los Angeles,[1] Ventura[1] *							36,300	16,500	16,500
Totals	615,936	$769,788	196,919	$374,097	1,130	$3,116	40,168	$22,270	$1,169,271

*Combined to conceal output of a single operator in each.
[1] Volcanic rock used as building stone and flag stone.
[2] Tuff used for building stone.

Granite Production of California, by Years.

The value of granite produced, annually, since 1887, has been as follows:

Year	Value	Year	Value
1887	$150,000	1910	$417,898
1888	57,000	1911	355,742
1889	1,329,018	1912	362,975
1890	1,200,000	1913	981,277
1891	1,300,000	1914	628,786
1892	1,000,000	1915	227,928
1893	531,322	1916	535,339
1894	228,816	1917	221,997
1895	224,329	1918	139,861
1896	201,004	1919	220,743
1897	188,024	1920	495,732
1898	147,732	1921	725,901
1899	141,070	1922	676,643
1900	295,772	1923	760,081
1901	519,285	1924	1,211,046
1902	255,239	1925	1,853,859
1903	678,670	1926	655,332
1904	467,472	1927	1,398,443
1905	353,837	1928	763,996
1906	344,083	1929	1,169,271
1907	373,376		
1908	512,923	Totals	$24,678,656
1909	376,834		

LIME

Bibliography: Reports XIV, XV, XVII–XXV (inc.). Bulletin 38.

In California during 1929 there was an output of lime to the amount of 42,834 tons valued at $417,101, coming from two plants in San Bernardino County, two in Santa Cruz County, and one each in El Dorado and Tuolumne counties. The above amount was a decrease from the 1928 output which was 56,616 tons, worth $547,919.

So far as we have been able to segregate the data, these figures include mainly only such lime as is used in building operations; though they do include a small proportion of calcined lime employed in agriculture and the chemical industries, the figures for which were not separable. A portion is hydrated lime. Limestone utilized in sugar making, for smelter flux, as a fertilizer, and other special industrial uses, are classified under 'Industrial Materials.' That consumed in cement manufacture is included in the value of cement.

Lime Production of California, by Years.

The following tabulation gives the amounts and value of lime produced in California by years since 1894 when compilation of such records was begun by the State Mining Bureau. The figures for quantity have been recalculated from 'barrels' to 'tons' for the years 1894–1922 (inc.):

Year	Tons	Value	Year	Tons	Value
1894	37,350	$318,700	1913	61,344	$528,547
1895	39,776	386,094	1914	43,996	378,663
1896	30,275	261,505	1915	35,653	286,304
1897	28,780	252,900	1916	49,364	390,475
1898	29,786	254,010	1917	50,073	311,380
1899	29,985	314,575	1918	43,684	461,315
1900	31,252	283,699	1919	42,070	552,043
1901	31,738	334,688	1920	46,314	557,232
1902	44,866	369,616	1921	46,353	610,619
1903	49,659	418,280	1922	57,875	671,747
1904	57,945	571,749	1923	70,894	788,834
1905	61,700	555,322	1924	62,029	703,355
1906	68,927	763,060	1925	61,922	685,528
1907	68,422	756,376	1926	63,568	670,837
1908	39,639	379,243	1927	60,498	631,497
1909	52,075	577,824	1928	56,616	547,919
1910	47,951	477,633	1929	42,834	417,101
1911	42,959	390,988			
1912	52,212	464,440	Totals	1,740,384	$17,324.148

MAGNESITE

Bibliography: State Mineralogist Reports XII–XV (inc.), XVII–XXV (inc.). Bulletins 38, 79, 91. U. S. Geol. Surv. Bulletins 355, 540; Min. Res. 1913, Pt. II, pp. 450–453. Min. & Sci. Press, Vol. 114, p. 237. "Magnesite"—Hearings before the Comm. on Ways and Means, House of Repr., on H. R. 5218, June 16, 17, and July 17, 1919. Eng. Soc. W. Penn., Proc. 1913, Vol. 29, pp. 305–388, 418–444. Eng. & Min. Jour.-Press, Vol. 114, July 29, and Dec. 2, 1922. U. S. Tariff Comm., "Crude and Caustic Calcined Magnesite. A Preliminary Statement of Information," May 19, 1926.

The production of magnesite in California during 1929 amounted to a total of 47,269 tons, crude ore, valued at $488,014. Only a very small part of it was sold 'crude,' however, as it was practically all shipped in the calcined form. The reports at hand show a total of 20,661 tons shipped calcined valued at $663,224 rail shipping point; of this about 25% was dead-burned for refractory purposes, the balance going to the plastic trade. This material came from San Benito, Santa Clara, Stanislaus and Tulare counties with a single producer in each. From 2 to 2½ tons of crude material are mined to make one ton of calcined. The 1929 output showed a decreased value, although there was a slight increase in quanity over the 1928 figure which was 45,645 tons crude valued at $501,590. The average of the values reported for 1929 is $10.32 per ton compared with $11.00 in 1928 and $12.50 in 1927.

Occurrence.

Magnesite is a natural carbonate of magnesium, and when pure contains 52.4% CO_2 (carbon dioxide), and 47.6% MgO (magnesia). It has a hardness of 3.5 to 4.5, and specific gravity of 3 to 3.12. It is both

harder and heavier than calcite (calcium carbonate), and also contains a higher percentage of CO_2 as calcite has but 44%.

Most of the Californian magnesite is comparatively pure, and is ordinarily a beautiful, white, fine-grained rock with a conchoidal fracture resembling a break in porcelain. The Grecian magnesite is largely of this character; but the Austrian varieties usually contain iron, so that they become brown after calcining. The Washington magnesite resembles dolomite and some crystalline limestones in physical appearance. Its color varies through light to dark gray, and pink.

In California the known deposits are mostly in the metamorphic rocks of the Coast Ranges and the Sierra Nevada, being associated with serpentine areas. The notable exceptions are the sedimentary deposits at Bissell in Kern County and at Afton in San Bernardino County. Several thousand tons have been shipped from the Bissell deposit; and small shipments have been made from the Afton property.

The Washington deposits are associated with extensive strata of dolomite limestone. The magnesite there appears to contain more iron than most of the California mineral, which makes it desirable for the steel operators. However, recent experience has proved that several California localities have sufficient iron in their magnesite to be serviceable in the steel furnaces.

Uses.

The principal uses include: Refractory linings for basis open-hearth steel furnaces, copper reverberatories and converters, bullion and other metallurgical furnaces; in the manufacture of paper from wood pulp; and in structural work, for exterior stucco, for flooring, wainscoting, tiling, sanitary kitchen and hospital finishing, etc. In connection with building work it has proved particularly efficient as a flooring for steel railroad coaches, on account of having greater elasticity and resilience than 'Portland' cement. For refractory purposes, the magnesite is 'dead-burned'—*i. e.*, all or practically all of the CO_2 is expelled from it. For cement purposes it is left 'caustic'—*i. e.*, from 2% to 10% of CO_2 is retained. When dry caustic magnesite is mixed with a solution of magnesium chloride ($MgCl_2$) in proper proportions, a very strong cement is produced, known as oxychloride or Sorel cement. It is applied in a plastic form, which sets in a few hours, as a tough, seamless surface. It has also a very strong bonding power, and will hold firmly to wood, metal, or concrete as a base. It may be finished with a very smooth, even surface, which will take a good wax or oil polish. As ordinarily mixed there is added a certain proportion of wood flour, cork, asbestos, or other filler, thereby adding to the elastic properties of the finished product. Its surface is described as 'warm' and 'quiet' as a result of the elastic and nonconducting character of the composite material. The cement is frequently colored by the addition of some mineral pigment to the materials before mixing as cement.

For refractory purposes the calcined magnesite is largly made up into bricks similar to fire-brick for furnace linings. It is also used unconsolidated, as 'grain' magnesite. For such, an iron content is desirable, as it allows a slight sintering in forming the brick. Dead-burned, pure magnesia can not be sintered except at very high temperatures; and it has little or no plasticity, so that it is hard to handle. Its plasticity is said to be improved by using with it some partly calcined

or caustic magnesite. Heavy pressure will bind the material sufficiently to allow it to be sintered.

A coating of crushed magnesite is laid on hearths used for heating steel stock for rolling, to prevent the scale formed from attacking the fire-brick of the hearth.

Before the World War, practically all of the domestic output of caustic magnesite was used in the manufacture of pulp and paper. For this purpose calcined dolomite is now used. The use of dolomite instead of magnesite by the paper manufacturers began during the war when the price of magnesite was very high. Dolomite was found to be a good substitute for magnesite in the bisulphite process of paper making and so its use has continued.

Imports.

The tariff act of 1930 placed the following import duties on magnesite: Crude magnesite $\frac{15}{32}$¢ per lb., caustic-calcined magnesite $\frac{15}{16}$¢ per lb.; dead-burned and grain magnesite, not suitable for manufacture into oxychloride cements, $\frac{23}{40}$¢ per lb; magnesite brick $\frac{3}{4}$¢ per lb. and 10% ad valorem. The figures of imports for 1929, as published by the U. S. Bureau of Foreign and Domestic Commerce, show a total of 53,182 short tons of calcined ore, valued at $819,219, as compared with 63,501 tons and $974,869 in 1928.

Total Magnesite Production of California.

The first commercial production of magnesite in California was made in the latter part of 1886 from the Cedar Mountain district,[1] southeast of Livermore, Alameda County. Shipments amounting to 'several tons' or 'several carloads' were sent by rail to New York; but there is apparently no exact record of the amount for that first year. The statistical records of the State Mining Bureau began with the year 1887, and the table herewith shows the figures for amount and value, annually, from that time. Shipments of magnesite from Napa County began in 1891 from the Snowflake Mine; from the Red Mountain deposits in Santa Clara County, in 1899; and from Tulare County in 1900.

Total Magnesite Production of California

Year	Tons	Value	Year	Tons	Value
1887	600	$9,000	1910	16,570	$113,887
1888	600	9,000	1911	8,858	67,430
1889	600	9,000	1912	10,512	105,120
1890	600	9,000	1913	9,632	77,056
1891	1,500	15,000	1914	11,438	114,380
1892	1,500	15,000	1915	30,271	283,461
1893	1,093	10,930	1916	154,052	1,311,893
1894	1,440	10,240	1917	209,648	1,976,227
1895	2,200	17,000	1918	83,974	803,492
1896	1,500	11,000	1919	44,696	452,094
1897	1,143	13,671	1920	83,695	1,033,491
1898	1,263	19,075	1921	47,837	511,102
1899	1,280	18,480	1922	55,637	594,665
1900	2,252	19,333	1923	73,963	946,643
1901	4,726	43,057	1924	67,236	900,183
1902	2,830	20,655	1925	64,623	872,944
1903	1,361	20,515	1926	50,915	587,642
1904	2,850	9,298	1927	46,093	577,887
1905	3,933	16,221	1928	45,645	501,590
1906	4,032	40,320	1929	47,269	488,014
1907	6,405	57,720			
1908	10,582	80,822	Totals	1,225,246	$12,856,126
1909	7,942	62,588			

[1] See U. S. Geol. Surv.; Mineral Resources of U. S., 1886, pp. 6 and 696.

MARBLE

Bibliography: State Mineralogist Reports XII–XV (inc.), XVII–XXV (inc.). Bulletin 38. U. S. Bur. of Mines, Bull. 106.

The 1929 figures show an increase in both quantity and value over those of 1928 and are combined with onyx and travertine to conceal the output of that material. The 1929 production came from a single operator in each of the following counties: Amador, Inyo, Los Angeles, San Luis Obispo, Santa Barbara, and Tuolumne. During the last few years there has been a steadily increasing demand for flat stratified stones or flagstone to be used with both Spanish and English types of architecture. The material from Los Angeles, San Luis Obispo, and Santa Barbara counties belonged to this type.

California has many beautiful and serviceable varieties of marble, suitable for almost any conceivable purpose of construction or decoration. In the decorative class are deposits of onyx marble of beautiful coloring and effects. There is also serpentine marble suitable for electrical switchboard use.

Marble Production of California, by Years.

Data on annual production since 1887, as compiled by the State Mining Bureau, follows. Previous to 1894 no records of amounts were preserved.

Year	Cubic feet	Value	Year	Cubic feet	Value
1887		$5,000	1910	18,960	50,200
1888		5,000	1911	20,201	54,103
1889		87,030	1912	27,820	74,120
1890		80,000	1913	41,654	113,282
1891		100,000	1914	25,436	48,832
1892		115,000	1915	22,186	41,518
1893		40,000	1916	25,954	50,280
1894	38,441	98,326	1917	24,755	62,950
1895	14,864	56,566	1918	[a]17,428	49,898
1896	7,889	32,415	1919	25,020	74,482
1897	4,102	7,280	1920	[b]29,531	92,899
1898	8,050	23,594	1921	30,232	98,395
1899	9,682	10,550	1922	38,321	127,792
1900	4,103	5,891	1923	28,015	124,919
1901	2,945	4,630	1924	[b]61,579	140,253
1902	19,305	37,616	1925	35,664	116,105
1903	84,624	97,354	1926	34,806	119,999
1904	55,401	94,208	1927	[b]42,308	103,689
1905	73,303	129,450	1928	[b]34,324	82,190
1906	31,400	75,800	1929	[b]72,881	93,661
1907	37,512	118,066			
1908	18,653	47,665	Total value		$3 229,408
1909	79,600	238,400			

[a] Includes onyx and serpentine.
[b] Includes onyx and travertine.

ONYX and TRAVERTINE

Bibliography: State Mineralogist Reports XII–XV (inc.), XVII, XVIII, XXI, XXIII. Bulletin 38.

Onyx and travertine are known to exist in a number of places in California, but there has been only a small and irregular production since the year 1896. In 1929 there were two producers of travertine in Solano County. The 1929 output showed a slight decrease in both quantity and value from that of 1928 the figures of which are combined

with marble. This material is used in terrazzo, auto gear-shift handles, bases for fountain-pen desk sets, and other ornamental purposes.

Onyx Production of California, by Years.

Production by years has been as follows:

Year	Value	Year	Value
1887	$900	1920	*
1888	900	1921	$1,294
1889	900	1922	3,320
1890	1,500	1923	2,510
1891	2,400	1924	*
1892	1,800	1925	16,120
1893	27,000	1926	7,575
1894	20,000	1927	*
1895	12,000	1928	*
1896	24,000	1929	*
1918	*		
1919		Total value	$122,219

* See under Marble.

SANDSTONE

Bibliography: State Mineralogist Reports XII–XV, XVII, XVIII, XXI, XXIII. Bulletin 38. U. S. Bur. of M., Bull. 124.

An unlimited amount of high-grade sandstone is available in California, but the wide use of concrete in buildings of every character, as well as the popularity of a lighter-colored building stone, has curtailed production in this branch of the mineral industry during recent years almost to the vanishing point. In 1929 a total of 177,655 cu. ft. valued at $49,881 was quarried in Los Angeles, Monterey, Napa, Sonoma, and Tehama counties by thirteen producers; compared with 134,100 cu. ft. valued at $43,250 in 1928.. Practically all of the material was flagstone which is used in garden walks, fountains, walls and fireplaces to give effect to Spanish and English types of homes. The material reported from Monterey County is in reality an indurated shale of the Monterey series, of a cream color and utilized as a building stone; and that from Sonoma is a stratified, altered andesite having the appearance of sandstone.

A large portion of the sandstone was sold for landscape work and used as stepping stones for walks and for fountains, walls, etc.

Sandstone Production of California, by Years.

Amount and value, so far as contained in the records of this Bureau, are presented herewith, with total value from 1887 to date:

Year	Cubic feet	Value	Year	Cubic feet	Value
1887		$175,000	1910	165,971	$80,443
1888		150,000	1911	255,313	127,314
1889		175,598	1912	66,487	22,574
1890		100,000	1913	62,227	27,870
1891		100,000	1914	111,691	45,322
1892		50,000	1915	63,350	8,438
1893		26,314	1916	17,270	10,271
1894		113,592	1917	31,090	7,074
1895		35,373	1918	900	400
1896		28,379	1919	5,400	3,720
1897		24,086	1920	10,500	2,300
1898		46,384	1921	10,150	2,112
1899	56,264	103,384	1922	900	1,100
1900	378,468	254,140	1923	7,000	13,000
1901	266,741	192,132	1924	6,700	3,600
1902	212,123	142,506	1925	14,704	14,362
1903	353,002	585,309	1926	34,100	17,500
1904	363,487	567,181	1927	22,900	205,400
1905	302,813	483,268	1928	134,100	43,250
1906	182,076	164,068	1929	177,655	49,881
1907	159,573	148,148			
1908	93,301	55,151	Total value		$4,442,976
1909	79,240	37,032			

SERPENTINE

Bibliography: State Mineralogist Report XV. Bulletin 38.

Serpentine has not been produced in California to a very large extent at any time. A single deposit, that on Santa Catalina Island, has yielded the principal output to date. Some material was shipped from there in 1917 and 1918, being the only output recorded since 1907. It was used for decorative building purposes and for electrical switchboards. As there was but a single operator, the figures were combined with those of marble output for those years.

Serpentine Production of California, by Years.

The following table shows the amount and value of serpentine from 1895 as recorded by this Bureau:

Year	Cubic feet	Value	Year	Cubic feet	Value
1895	4,000	$4,000	1904	200	$2,310
1896	1,500	6,000	1905		
1897	2,500	2,500	1906	847	1,694
1898	750	3,000	1907	1,000	3,000
1899	500	2,000	1917	[a]	[a]
1900	350	2,000	1918	[b]	[b]
1901	89	890	1919		
1902	512	5,065			
1903	99	800	Totals	12,347	$33,259

[a] Under 'Unapportioned.'
[b] See under Marble.

SLATE

Bibliography: State Mineralogist Reports XV, XVIII, XXIV. Bulletin 38. U. S. Geol. Surv., Bull. 586. U. S. Bur. of Mines, Bull. 218.

Slate was first produced in California in 1889. Up to and including 1910 such production was continuous, but since then it has been irregu-

lar. Large deposits of excellent quality are known in the state, especially in El Dorado, Calaveras and Mariposa counties, but the demand has been light owing principally to competition of cheaper roofing materials.

'Slate' is a term applied to a fine-grained rock that has a more or less perfect cleavage, permitting it to be readily split into thin, smooth sheets. Varieties differ widely in color and have a considerable range in chemical and mineralogical composition. Excepting certain rare slates of igneous origin (of which the green slate of the Eureka quarry, El Dorado County, California, is an example) formed from volcanic ash or igneous dikes, slates have originated from sedimentary deposits consisting largely of clay. By consolidation, and the pressure of superimposed materials, clays become bedded deposits of shale. By further consolidation under intense pressure and high temperature incident to mountain-building forces, shales are metamorphosed to slates. The principal mineral constituents are mica, quartz, and chlorite, with smaller varying amounts of hematite, rutile, kaolin, graphite, feldspar, tourmaline, calcite, and others.

The color of slate is of economic importance. The common colors are gray, bluish gray, and black, though reds and various shades of green are occasionally found.

The permanency of slate for roofing is well known. It is stated that there are slate roofs in Pennsylvania and Maryland over 100 years old.

"In England and Wales, and in France, many buildings constructed in the 15th and 16th centuries were roofed with slate, and the roofs are still in excellent condition. There is a record of a chapel in Bedford-on-Avon in Wiltshire, England, roofed with slate in the 8th century, and after 1200 years of climatic exposure is moss-covered but in good condition." [1]

Contrary to the general impression, however, the major portion of the slate produced in the United States is used on the inside rather than the outside of buildings. Its interior uses include stationary washtubs, electrical switchboards, and blackboards.

A square of roofing slate is a sufficient number of pieces of any size to cover 100 square feet of roof, with allowance generally for a three-inch lap. The sizes of the pieces of slate making up a square range from 7 x 9 inches to 16 x 24 inches, and the number of pieces in a square ranges from 85 to 686. The Ferry Building, San Francisco, is roofed with Eureka slate from El Dorado County.

During 1929 there was in California an increase in both quantity and value of the slate output over the 1928 output which amounted to 4075 tons valued at $31,263. The figures are concealed under 'Unapportioned' owing to a single operator in both El Dorado and Tuolumne counties. Practically all of this slate was crushed and used for roofing granules.

[1] Bowles, O., Slate as a Permanent Roofing Material: U. S. Bur. of M., Reports of Investigations, Serial No. 2267, July, 1921, p. 4.

Total Production of Slate in California.

A complete record of amount and value of slate produced in California follows:

Year	Squares	Value	Year	Squares	Value
1889	4,500	$18,089	1907	7,000	$60,000
1890	4,000	24,000	1908	6,000	60,000
1891	4,000	24,000	1909	6,961	45,660
1892	3,500	21,000	1910	1,000	8,000
1893	3,000	21,000	1911		
1894	1,800	11,700	1915	1,000	5 000
1895	1,350	9,450	1916		
1896	500	2,500	1920	8	80
1897	400	2,800	1921		
1898	400	2,800	1922	200	2,400
1899	810	5,900	1923		
1900	3,500	26,250	1926	[a]	7,371
1901	5,100	38,250	1927	[b]2,686	17,960
1902	4,000	30,000	1928	[b]4,075	31,263
1903	10,000	70,000	1929	*	*
1904	6,000	50,000			
1905	4,000	40,000	Total value		$735,473
1906	10,000	100,000			

* Concealed under 'Unapportioned.'
[a] Quantity not shown as both 'squares' and 'tons' included.
[b] Tons.

MISCELLANEOUS STONE

Bibliography: State Mineralogist Reports XII–XXVI (inc.). Bulletin 38; also annual statistical bulletins from 1915 to date.

'Miscellaneous stone' is the name used throughout this report as the title for that branch of the mineral industry covering crushed rock of all kinds, paving blocks, sand and gravel, and pebbles for grinding mills. The foregoing are very closely related from the standpoint of the producer; therefore it has been found to be most satisfactory to group these items as has been done in recent reports of this Bureau. So far as it has been possible to do so, crushed rock production has been subdivided into the various uses to which the product was put. It will be noted, however, a very large percentage of the output has been tabulated under the heading 'Unclassified.' This is necessary because of the fact that many of the producers have no way of telling to what specific use their rock was put (or at least the proportions to each use) after they have quarried and sold the same to distributors and contractors.

In addition to amounts produced by commercial firms, both corporations and individuals, there is hardly a county in the state but uses more or less gravel and broken rock on its roads. Of much of this, particularly in the country districts, there is no definite record kept.

For the year 1929 the production of crushed rock for California showed gains in both quantity and value over the preceding year, but sand and gravel registered a loss in their totals for tonnage and value. This resulted in a total value of $17,840,159 for 'miscellaneous stone' in 1929 as compared with $17,332,110 in 1928 although there was a slight decrease in total tonnage in 1929. This is attributed to the fact that the sand and gravel decrease in tonnage was in excess of the crushed rock advance.

As for several years past, Los Angeles County led all other counties by a wide margin, with an output valued at $5,335,300 (compared with

$5,633,815 in 1928); Alameda second with $1,592,232; San Diego third, with $777,481; Amador fourth, with $696,500; San Bernardino fifth, with $639,111; followed by San Benito, Butte, Sacramento, Riverside, Contra Costa, Yuba, Kern, Marin, Santa Clara, Calaveras, and Fresno, in the order named.

Paving Blocks.

During 1929 there were no paving blocks quarried in California.

The paving block industry has decreased materially of recent years, practically to the vanishing point, because of the increased construction of smoother pavements demanded by motor vehicle traffic. The blocks made in Solano County were of basalt; those from Sonoma are of basalt, andesite, and some trachyte, while those from Madera, Placer, Riverside, San Bernardino, and San Diego are of granite; and those from San Mateo County a sandstone.

The amount and value of paving block production, annually, since 1887 has been as follows:

Year	Amount M	Value	Year	Amount M	Value
1887	*10,000	$350,000	1909	4,503	$199,803
1888	10,500	367,500	1910	4,434	198,916
1889	7,303	297,236	1911	4,141	210,819
1890	7,000	245,000	1912	11,018	578,355
1891	5,000	150,000	1913	6,364	363,505
1892	*3,000	96,000	1914	6,053	270,598
1893	2,770	96,950	1915	3,285	171,092
1894	2,517	66,981	1916	1,322	54,362
1895	2,332	73,338	1917	938	38,567
1896	4,161	77,584	1918	372	17,000
1897	1,711	35,235	1919	27	1,350
1898	1,144	21,725	1920	63	3,155
1899	305	7,861	1921	4	280
1900	1,192	23,775	1922	72	3,924
1901	1,920	41,075	1923	15	880
1902	3,502	112,437	1924	11	935
1903	4,854	134,642	1925	27	1,350
1904	3,977	161,752	1926		
1905	3,408	134,347	1927	41	2,057
1906	4,203	173,432	1928	25	1,658
1907	4,604	199,347	1929		
1908	7,660	334,780	Totals	135,768	$5,319,603

* Figures for 1887–1892 (inc.) are for Sonoma County only, as none are available for other counties during that period though Solano County quarries were then also quite active.

Grinding Mill Pebbles.

Production of pebbles for tube and grinding mills began commercially in California in 1915. Owing to the decreased imports and higher prices of Belgium and other European flint pebbles, due to the war, there was a serious inquiry for domestic sources of supply. In 1916 and 1917 shipments totaled in excess of 20,000 tons per year; but they have since dropped to an insignificant figure. San Diego County has been the principal contributor, with some also from Fresno and Sacramento. Shipments have been made to metallurgical plants in California, Nevada, Montana and Utah.

Imports to the United States in 1929 amounted to 12,542 long tons, valued at $127,186, as compared with 14,035 long tons valued at $144,313 in 1928.

The 1929 output of grinding mill pebbles in California was concealed under 'Unapportioned' to conceal the production of a single operator in San Diego County.

The amount and value of grinding mill pebbles, annually, follows:

Year	*Tons*	*Value*
1915	340	$2,810
1916	20,232	107,567
1917	21,450	90,538
1918	8,628	61,268
1919	2,607	19,272
1920	2,104	17,988
1921	247	1,418
1922	1,571	7,628
1923	2,650	14,936
1924	434	2,969
1925	215	1,385
1926	102	612
1927	288	1,800
1928	372	2,408
1929	*	*
Totals	61,240	$262,599

* Annual details concealed under 'Unapportioned.'

Sand and Gravel.

A considerable part of the gravel excavated is passed through grading and washing plants, and the material over 2 inches in size is crushed. Much of it is utilized in concrete mixtures. Most of the gravel used for road surfacing and repairs as well as that for railroad ballast is creek-run or pit-run material which is spread upon the roads without undergoing any grading or washing.

Plant of the Antioch Sand Co. at Antioch, Contra Costa County.

The distribution of the 1929 output of sand and gravel, by counties, is given in the following table:

County	Tons	Value	County	Tons	Value
Alpine	10,874	7,548	Riverside	[a] [c]40,479	$68,929
Alameda	[a]1,417,323	$803,207	Sacramento	335,522	184,591
Amador	6,000	3,800	San Bernardino	[b]594,436	360,601
Butte	177,917	92,557	San Diego	[a]780,768	509,887
Calaveras	16,782	51,800	San Joaquin	254,893	102,817
Colusa	35,000	35,000	San Luis Obispo	[a]21,200	11,000
Contra Costa	[a]191,834	105,777	Santa Barbara	135,490	78,760
Del Norte	9,234	16,230	Santa Clara	455,005	290,613
Fresno	290,384	190,336	Santa Cruz	86,500	75,250
Glenn	383,690	52,516	Shasta	34,463	47,104
Humboldt	134,729	74,742	Sierra	2,350	2,550
Imperial	54,408	33,286	Siskiyou	10,743	11,706
Kern	[b]117,351	43,215	Sonoma	261,572	125,426
Lake	59,900	49,350	Stanislaus	253,695	167,325
Lassen	25,750	33,475	Tehama	8,335	9,956
Los Angeles	6,346,621	2,826,124	Trinity	1,420	1,600
Madera	13,345	10,748	Ventura	[a]385,613	256,030
Mariposa	21,631	11,181	Yolo	20,370	14,400
Mendocino	64,408	33,925	Yuba	243,083	150,326
Merced	60,250	22,200	Mono, Nevada, San Benito, San Mateo,[a] Solano and Tulare*	101,211	51,787
Modoc	113,490	30,346			
Monterey	[c]217,911	213,082			
Napa	32,205	24,123			
Orange	279,122	173,210	Totals	14,113,307	$7,463,036
Placer	6,000	4,600			

* Combined to conceal output of a single operator in each.
[a] Includes molding sand.
[b] Includes soil and loam.
[c] Includes blast sand.

Included in the above is a total of 58,296 tons of molding sand valued at $127,135 coming from two operators each in Contra Costa and San Diego counties, and one each in Alameda, Monterey, Riverside, San Luis Obispo, San Mateo, and Ventura counties. This item is each year assuming a more important position in the commercial mineral list of California. The 1928 figures totaled 60,523 tons valued at $131,349.

Crushed Rock.

To list the kinds and varieties of rock utilized commercially under this heading would be to run almost the entire gamut of the classification scale. Much depends on the kind available in a given district. Those which give the most satisfactory service are the basalts and other hard, dense, igneous rocks which break with sharp, clean edges. In many localities, river-wash boulders form an important source of such material. In such cases, combined crushing and washing plants obtain varying amounts of sand and gravel along with the crushed sizes. In Sacramento and Butte counties the tailings piles from the gold dredgers are the basis of like operations.

The values given are based on the selling price, f.o.b. cars, barges, or trucks, at the quarry.

Miscellaneous Stone Production of California, by Years.

The amount and value, annually, of crushed rock (including macadam, ballast, rubble, riprap, and that for concrete), and sand and gravel, since 1893, follow:

Crushed Rock, Sand and Gravel, by Years

Year	Tons	Value	Year	Tons	Value
1893	371,100	$456,075	1913	9,817,616	$4,823,056
1894	661,900	664,838	1914	9,288,397	3,960,973
1895	1,254,688	1,095,939	1915	10,879,497	4,609,278
1896	960,619	839,884	1916	9,951,089	4,009,590
1897	821,123	600,112	1917	8,069,271	3,505,662
1898	1,177,365	814,477	1918	6,641,144	3,325,889
1899	964,898	786,892	1919	6,919,188	3,678,322
1900	789,287	561,642	1920	9,792,122	6,782,414
1901	530,396	641,037	1921	10,914,145	7,834,940
1902	2,056,015	1,249,529	1922	13,049,644	10,366,231
1903	2,215,625	1,673,591	1923	19,840,301	15,379,838
1904	2,296,898	1,641,877	1924	21,451,129	15,962,476
1905	2,624,257	1,716,770	1925	23,819,137	17,407,113
1906	1,555,372	1,418,406	1926	24,987,606	19,859,261
1907	2,288,888	1,915,015	1927	25,126,691	18,912,994
1908	3,993,945	3,241,774	1928	27,471,794	17,328,044
1909	5,531,561	2,708,326	1929	27,104,618	17,840,159
1910	5,827,828	2,777,690			
1911	6,487,223	3,610,357	Totals	295,582,314	$208,532,769
1912	8,044,937	4,532,598			

A comparison of the above table of annual production of these materials with the similar table for cement (see *ante*) reveals the fact that the important growth of the crushed rock and gravel business has been coincident with the rapid development of the cement industry from the year 1902.

CRUSHED ROCK PRODUCTION, BY COUNTIES, FOR 1929

County	Macadam and ballast		Rubble and riprap		Concrete		Unclassified		Total	
	Tons	Value	Tons	Value	Tons	Value	Tons	Value	Tons	Value
Alameda	*		*		*		[1]854,391	$636,597	854,391	$636,597
Alpine	1,232	$1,487	200	$200	20,000	$20,000	5,000	2,500	26,432	24,187
Amador	23,000	17,700	1,350,000	675,000					1,373,000	692,700
Butte	337,462	238,937			52,336	32,592	[1]150,257	121,101	540,055	392,630
Calaveras	12,642	9,182			230,000	161,000	*		242,642	170,182
Contra Costa	140,879	109,544	28,640	16,114			262,832	182,402	432,351	308,060
Del Norte	72,746	67,150							72,746	67,150
El Dorado	17,125	23,845	1,820	1,820					18,945	25,665
Fresno	22,200	29,970			4,647	8,129	*		26,847	38,099
Glenn	66,900	29,000							66,900	29,000
Humboldt	70,664	149,680					*		70,664	149,680
Imperial	54,601	44,121	19,498	5,200	128,416	117,164	[2]106,488	30,428	309,003	196,913
Inyo	67,862	114,145					*		67,862	114,145
Kern	193,706	258,625			*				193,706	258,625
Lake	71,700	104,850							71,700	104,850
Lassen	28,700	54,853							28,700	54,853
Los Angeles	51,432	67,059	40,000	40,000	685,023	654,149	2,910,062	1,747,968	3,686,517	2,509,176
Mariposa	42,751	40,285					*		42,751	40,285
Mendocino	17,550	22,000							17,550	22,000
Mono	5,109	14,816							5,109	14,816
Napa	76,871	64,091	400	300	*		6,566	11,108	83,837	75,499
Nevada	54,430	83,570							54,430	83,570
Orange	71,555	28,884					[2]104,902	61,156	176,457	90,040
Placer			5,659	4,319	*		*		5,659	4,319
Plumas	96,472	71,538	15,665	8,882					112,137	80,420
Riverside	58,600	35,160	*				*		58,600	35,160
Sacramento	20,898	10,448	200	80	*		191,692	148,811	212,790	159,339
San Bernardino			*		*		[1]64,650	82,510	64,650	82,510
San Diego	21,100	42,200	*		1,995	3,603	244,072	221,385	267,167	267,188
San Mateo	134,019	194,729			*		*		134,019	194,729
Santa Barbara	88,459	114,107	149,790	71,878					238,249	185,985
Santa Clara							[2]37,526	42,289	37,526	42,289
Shasta	[4]253,082	200,247							253,082	200,247
Sierra	14,712	18,673							14,712	18,673
Siskiyou	[5]121,422	89,101			*		*		121,422	89,101
Sonoma	31,369	17,400	*		*				31,369	17,400
Stanislaus	*				24,682	22,647	*		24,682	22,647
Trinity	36,470	37,267	500	3,000					36,970	40,267
Tulare	15,025	24,040							15,025	24,040

Tuolumne	7,400	2,500							7,400	2,500
Ventura	28,653	29,153							28,653	29,153
Alameda, San Benito, San Francisco, San Joaquin, Stanislaus, Yuba*	782,307	604,556							782,307	604,556
Alameda, Marin, Merced, Riverside, San Bernardino, San Diego, San Luis Obispo, Sonoma*			442,111	588,583					442,111	588,583
Alameda, Kern, Marin, Napa, Placer, Sacramento, San Benito, San Bernardino, San Mateo, Siskiyou, Sonoma*					1,026,809	832,743			1,026,809	832,743
Calaveras,[1] Fresno, Humboldt, Inyo,[3] Madera, Marin, Mariposa,[1] Placer, Riverside, San Francisco, San Mateo, Siskiyou, Solano, Stanislaus, Tuolumne,[1 3] Yuba*							513,385	756,552	513,385	756,552
Totals	3,211,097	$3,064,913	2,054,483	$1,415,376	2,173,908	$1,852,027	5,451,823	$4,044,807	12,891,311	$10,377,123

*Combined to conceal the output of a single operator in each.
[1] Includes roofing granules.
[2] Includes decomposed granite.
[3] Includes granules for roofing and terrazzo.
[4] Includes slag.
[5] Includes volcanic cinder.

CHAPTER FIVE

INDUSTRIAL MATERIALS

Bibliography: State Mineralogist Reports XII-XXVI (inc.). Bulletin 38. Min. & Sci. Press, Vol. 114, March 10, 1917. Spurr and Wormser, "Marketing of Metals and Minerals." "Non-Metallic Minerals," by R. B. Ladoo. See also under each substance.

The following mineral substances have been arbitrarily arranged under the general heading of 'Industrial Materials,' as distinguished from those which have a clearly-defined classification, such as metals, salines, structural materials, etc.

These materials, many of which are mineral earths, are, with four or five exceptions, as yet produced on a comparatively small scale. The possibilities of development along several of these lines are large, and with increasing transportation and other facilities, together with steadily growing demands, the future for this branch of the mineral industry in California is promising. There is scarcely a county in the state but might contribute to the output.

Up to within the last few years, at least, production has been in the majority of instances dependent upon more or less of a strictly local market, and the annual tables show the results of such a condition, not only in the widely-varying amounts of a certain material produced from year to year, but in widely-varying prices of the same material.

The more important of these minerals thus far exploited, so far as shown by value of the output, are barytes, clay (pottery), diatomaceous earth, dolomite, fuller's earth, gypsum, limestone, mineral water, pyrite, sillimanite, soapstone and talc.

This group as a whole showed an increase in the total value to $7,581,743 in 1929 from $5,699,963 in 1928.

ASBESTOS

Bibliography: State Mineralogist Reports XII–XIX (inc.), XXII, XXV. Bulletins 38, 91. Canadian Dept. of M., Mines Branch Bulletin 69. Min. & Sci. Press, April 10, 1920, pp. 531–533. Eng. & Min. Jour.-Press, Vol. 113, pp. 617–625, 670–677. Asbestology, Vol. 5, No. 7, July, 1927.

In 1929 there was a small tonnage of amphibole asbestos ore mined in Shasta County, from which fiber was produced, but owing to a single operator, the figures are concealed under the 'Unapportioned' item.

The future of asbestos mining in California is dependent largely upon the development of uses in quantity for the short-fibre mill grades, and for the amphibole variety. There are apparently large resources of such material that can be made available. Some spinning-grade fibre has also been found in this state, notably in Nevada, Calaveras, and Monterey counties, but the commercial yield to date has been

The following table gives the comparative figures for the amounts and values of industrial minerals produced in California during the years 1928 and 1929:

Substance	1928 Amount	1928 Value	1929 Amount	1929 Value	Increase+ Decrease— Value
Barytes	13,406 tons	$55,888	26,796 tons	$168,829	$112.941+
Clay (pottery)	887,807 tons	1,394,950	839,949 tons	1,127,517	267,433—
Dolomite	38,379 tons	85,342	58,644 tons	156,928	71,586+
Feldspar	14,628 tons	93,745	13,327 tons	78,404	15,341—
Fuller's earth	53,323 tons	501,743	15,541 tons	170,563	331,180—
Gems	--------	22,200	--------	26,850	4,650+
Gypsum	104,790 tons	200,567	140,844 tons	396,951	196,384+
Limestone	127,895 tons	397,935	168,315 tons	557,617	159,682+
Mineral paint	*	*	467 tons	2,820	* —
Mineral water	25,049,002 gallons	1,304,969	27,032,083 gal.	2,040,615	735,646+
Pumice and volcanic ash	10,440 tons	105,055	10,449 tons	76,123	28,932—
Pyrite	90,566 tons	400,627	79,169 tons	363,717	36,910—
Silica (sand and quartz)	14,814 tons	66,670	18,686 tons	79,210	12,540+
Soapstone and talc	18,668 tons	251,372	18,676 tons	193,493	57,879—
Unapportioned	--------	[a] 818,900	--------	[b] 2,142,106	1,323,206+
Total value	---------	$5,699,963	---------	$7,581,743	--------
Net increase					$1,881,780+

* Under 'Unapportioned.'

[a] Includes asbestos, diatomaceous earth, lithia, mineral paint, sillimanite-andalusite-cyanite group.

[b] Includes asbestos, diatomaceous earth, mica, sillimanite-andalusite-cyanite group, and sulphur.

small. There are extensive serpentine areas in the Coast Ranges, in the Klamath Mountains, and in several sections of the Sierra Nevada which are within the range of possible asbestos producers, as chrysotile is a fibrous form of serpentine. These localities all yielded chromite in greater or less amounts during the World War period.

Three-quarters of the world's supply of asbestos was for many years produced by Canada.

At present, Rhodesia furnishes 60 per cent of the long fibre, though Canada in addition to its long fibre still accounts for practically the entire output of lower grades.

Asbestos Production of California, by Years.

Total amount and value of asbestos production in California since 1887, as given in the records of this Bureau, are as follows:

Year	Tons	Value	Year	Tons	Value
1887	30	1,800	1910	200	$20,000
1888	30	1,800	1911	125	500
1889	30	1,800	1912	90	2,700
1890	71	4,260	1913	47	1,175
1891	66	3,960	1914	51	1,530
1892	30	1,830	1915	143	2,860
1893	50	2,500	1916	145	2,380
1894	50	2,250	1917	136	10,225
1895	25	1,000	1918	229	9,903
1896			1919*		
1897			1920*	131	6,240
1898	10	200	1921	410	19,275
1899	30	750	1922	50	1,800
1900	50	1,250	1923	20	200
1901	110	4,400	1924	70	4,750
1902			1925*		
1903			1926*	25	1,650
1904	10	162	1927*		
1905	112	2,625	1928*	13	1,160
1906	70	3,500	1929	*	*
1907	70	3,500			
1908	70	6,100	Totals	2,864	$136,535
1909	65	6,500			

*Annual details concealed under 'Unapportioned.'

BARYTES

Bibliography: State Mineralogist Reports XII, XIV, XV, XVII, XXI, XXVI, (inc.). Bulletins 38, 87. Eng. & Min. Jour.-Press, Vol. 114, p. 109, July 15, 1922; Vol. 115, pp. 319–324, Feb. 17, 1923; U. S. Bureau of Mines. Inform. Circ. 6221, 6223.

Commercial shipments of crude barytes in California in 1929 amounted to a total of 26,796 short tons valued at $168,829 f. o. b. rail shipping point, being an increase in both quantity and value over the 1928 figures, which were 13,406 short tons and $55,888. The 1929 yield came from a single property each in Mariposa, Nevada and Santa Barbara counties and two properties in San Bernardino County. This material was consumed in the manufacture of lithopone, as heavy-gravity oil-well drilling mud and barium chemicals. The mining of barytes has been showing a steady increase with the 1929 showing the largest annual production.

More than half of the total tonnage of barytes utilized in the United States is taken in the manufacture of lithopone, which is a chemically-prepared white pigment containing approximately 70% barium sulphate and 30% zinc sulphide. This is one of the principal constituents of

'flat' wall paints. Other important uses for barytes, after washing and grinding, are as an inert pigment and filler in paint, paper, linoleums, oilcloth and rubber manufacture, and in the preparation of a number of chemicals including barium binoxide, carbonate, chloride, nitrate, and the sulphate precipitated, or 'blanc fixe.'

The Tariff Act of 1930 placed a duty on foreign imported barytes ore, crude or unmanufactured, of $4 per ton; ground or otherwise manufactured, of $7.50 per ton.

Present quotations for barytes (93% $BaSO_4$) vary from $7 to $7.75 per ton, crude, f. o. b. rail-shipping point. Most baryte has to be washed and acid treated to remove iron stains or other impurities before being suitable for paint use.

Known occurrences of this mineral in California are located in Inyo, Los Angeles, Mariposa, Monterey, Nevada, San Bernardino, Shasta and Santa Barbara counties. The deposits at El Portal, in Mariposa County, have given the largest commercial production to date, in part witherite (barium carbonate, $BaCO_3$). Witherite has also been found in Shasta County, but no shipments have yet been made from the deposit.

Total Barytes Production of California.

The first recorded production of barytes in California, according to the statistical reports of the State Mining Bureau, was in 1910. The annual figures are as follows:

Year	Tons	Value	Year	Tons	Value
1910	860	$5,640	1921	901	$4,809
1911	309	2,207	1922	3,370	18,925
1912	564	2,812	1923	2,925	16,058
1913	1,600	3,680	1924		
1914	2,000	3,000	1925		
1915	410	620	1926	4,978	38,165
1916	1,606	5,546	1927	17,993	90,617
1917	4,420	25,633	1928	13,406	55,888
1918	100	1,500	1929	26,796	168,829
1919	1,501	18,065			
1920	3,029	20,795	Totals	86,768	$482,759

CLAY (Pottery)

Bibliography: State Mineralogist Reports I, IV, IX, XII–XV, XVIII–XXVI (inc.). Bulletins 38, 99. Preliminary Report No. 7. U. S. Bureau of Standards, Tech. Paper No. 262.

At one time or another in the history of the state, pottery clay has been mined in thirty-three of its counties. Of these, 19 contributed in 1928. In this report, 'pottery clay' refers to all clays used in the manufacture of red and brown earthenware, china and sanitary ware, flower pots, floor, faience and ornamental tiling, architectural terra cotta, sewer pipe, drain and roof tile, etc., and the figures for amount and value are relative to the crude material at the pit, without reference to whether the clay was sold in the crude form or was immediately used in the manufacture of any of the above finished products by the producer. It does not include clay use in making brick and hollow building blocks.

There are many other important uses for clay besides pottery manufacture. Among these may be enumerated paper, cotton goods, and

chemicals. Being neutral, clay does not have an injurious effect upon other constituents used in the manufacture of such articles. In paper making, clay is used as a filler in news and similar grades, and as a coater or glazer in the more highly-finished art papers. A large part of the china clay used in the United States is imported from England. Clays of the montmorillonite and halloysite group ('rock soap') are being utilized successfully in the manufacture of soaps and for filtering oils.

During 1929 a total of 64 producers in 19 counties reported an output of 839,949 short tons of pottery clay, having a total value of $1,127,517 f. o. b. rail-shipping point for the crude material as compared with the 1928 production of 887,807 tons worth $1,394,950.

Because of the fact that a given product often requires a mixture of several different clays, and that these are not all found in the same pit, it is necessary for most clay-working plants to buy some part of their raw materials from other localities. For these reasons, in compiling the clay industry figures, much care is required to avoid duplications. So far as we have been able to segregate the figures, from the data sent in by the operatives, we have credited the clay output to the counties from which the raw material originated; and have deducted tonnages used in brick manufacture, as bricks are classified separately, herein.

A tabulation of the direct returns from the producers, by counties, for the year 1929 is shown herewith:

Pottery Clay in 1929

County	Tons	Value	Used in the manufacture of
Alameda	7,037	$6,980	Architectural terra cotta; chimney, drain, and sewer pipe; faience, floor, decorative and roofing tile; garden furniture, and various.
Amador	60,487	88,846	Architectural terra cotta; fire-clay products and refractories; chimney, sewer and drain pipe; floor and roofing tile, and various.
Contra Costa	7,003	6,327	Floor, art, mantel, and roofing tile; drain pipe and various.
Kern	[1]58,551	85,845	Electrical porcelain, sanitary ware and various; oil-well mudding.
Los Angeles	88,066	49,304	Architectural terra cotta; conduits, segment blocks, electrical porcelain, red earthenware, refractories, drain, chimney, and sewer pipe; faience, floor and roofing tile; art pottery and various.
Orange	30,147	111,349	Stone ware, refractories; faience, drain, floor, and roofing tile, and various.
Placer	118,704	158,531	Architectural terra cotta; drain, chimney, and sewer pipe; faience, floor, mantel, and roofing tile; red earthenware, refractories, and various.
Riverside	[1]184,179	319,130	Conduit, sewer, and drain pipe; red earthenware; faience, floor, mantel, and roofing tile; refractories, and various; oil-well mudding.
San Bernardino	[2]2,596	15,874	Floor and roofing tile, art pottery, refractories, oil-well mudding, and various.
San Diego	20,148	34,020	Sewer and drain pipe; faience, floor, and roofing tile; sanitary ware, and various.
Santa Clara	13,799	13,871	Sewer pipe, art pottery; drain, faience, floor, mantel, and roofing tile, and various.
Ventura	[1]232,881	197,152	Drain and roofing tile, oil-well mudding, and various.
Calaveras, Humboldt, Imperial[2], Mono, Monterey, Sacramento, and Stanislaus*	16,346	40,288	Architectural terra cotta; chimney, drain, and sewer pipe; flue lining, faience, floor, mantel, and roofing tile, and various.
Totals	839,949	$1,127,517	

* Combined to conceal the output of a single operator in each.
[1] Includes clay and shale for oil-well mudding.
[2] Includes bentonite used in oil-well mudding.

Pottery Clay Products.

The values of the various pottery clay products made in California during 1929 totaled $14,452,889 as compared with $14,767,848 in 1928, their distribution being shown in the following tabulation:

Product	Number of producers	Tons	Value
Architectural terra cotta, chimney pipe and flue lining	7		$2,032,427
Drain pipe	15	6,362	86,805
Roofing tile	29	105,229	1,521,438
Sewer pipe	6		2,088,041
Chinaware, semivitreous tableware	4		605,866
Sanitary ware	4		2,619,473
Red earthenware	7		332,223
Stoneware and chemical stoneware	3		200,986
Floor, faience, mantel, glazed, and handmade tile	33		3,522,700
Ground clay and fire cement	9	7,006	90,642
Miscellaneous: ornamental tile, stove blocks, artware, decorative tile, specialties, vent grilles, radiants, conduits, terra cotta and garden furniture, segment blocks, crushed brick and various	14		919,057
Electrical porcelain	3		433,231
Total value			$14,452,889

Important increases were shown in flat tile (floor, faience, mantel, etc.), red earthenware, chinaware and semivitreous tableware and miscellaneous group, with decreases shown by architectural terra cotta, sanitary ware, chimney pipe, sewer pipe and roofing.

Pottery Clay Production of California, by Years.

Amount and value of crude pottery clay output in California since 1887 are given in the following table:

Year	Tons	Value	Year	Tons	Value
1887	75,000	$37,500	1909	299,424	$465,647
1888	75,000	37,500	1910	249,028	324,099
1889	75,000	37,500	1911	224,576	252,759
1890	100,000	50,000	1912	199,605	215,683
1891	100,000	50,000	1913	231,179	261,273
1892	100,000	50,000	1914	179,948	167,552
1893	24,856	67,284	1915	157,866	133,724
1894	28,475	35,073	1916	134,636	146,538
1895	37,660	39,685	1917	166,298	154,602
1896	41,907	62,900	1918	112,423	166,788
1897	24,592	30,290	1919	135,708	245,019
1898	28,947	33,747	1920	203,997	440,689
1899	40,600	42,700	1921	225,120	362,172
1900	59,636	60,956	1922	277,232	473,184
1901	55,679	39,144	1923	376,863	697,841
1902	67,933	74,163	1924	417,928	651,857
1903	90,972	99,907	1925	537,587	674,376
1904	84,149	81,952	1926	801,461	806,509
1905	133,805	130,146	1927	867,419	872,661
1906	167,267	162,283	1928	887,807	1,394,950
1907	160,385	254,454	1929	839,949	1,127,527
1908	208,042	325,147			
			Totals	9,305,959	$11,837,781

DIATOMACEOUS EARTH

Bibliography: State Mineralogist Reports II, XII–XV (inc.), XVII–XXV (inc.). Bulletins 38, 67, 91. Am. Inst. Min. Eng. Bull., 104, August, 1915, pp. 1539–1550. U. S. Bur. of Mines, Rep. of Investigations: Serial No. 2431, Jan., 1923. Eng. & Min. Jour.-Press, Vol. 115, pp. 1152–1154, June 30, 1923.

Infusorial and diatomaceous earths—sometimes called tripolite—are very light and extremely porous, chalk-like materials composed of pure

silica (chalk, being calcareous) which have been laid down under water and consist of the remains of microscopical infusoria and diatoms. The former are animal remains, and the latter are from plants. The principal commercial use of diatomaceous earth (also called 'diatomite') is as an absorbent. It is also employed in the manufacture of scouring soap and polishing powders; for filtration purposes; in making some classes of refractory brick; and as an insulating medium both in heating and refrigeration. It is a first-class nonconductor of heat, where high temperatures are employed, such as around steel and gas plants and power houses. In such cases, it is built in as an insulating layer in furnace walls. In Germany, under the name 'kieselguhr,' it was used as an absorbent for nitroglycerine in the early manufacture of dynamite.

As a nonconductor of heat it has been used alone or with other materials as a covering for boilers, steam pipes and safes, and in fireproof cement. It is used largely by paint manufacturers as a wood filler. Boiled with shellac it is made into records for talking machines. It has been used for absorbing liquid manures so that they could be utilized as fertilizers, and as a source of silica in making water-glass as well as in the manufacture of cement, tile glazing, artificial stone, ultramarine and other pigments of aniline and alizarine colors, paper filling, sealing wax, fireworks, hard-rubber objects, matches, and papier maché, and for solidifying bromine. For making insulating brick the material is sawed into blocks, and for all other purposes it is ground and screened.

The most important deposits in California thus far known are located in Monterey, Orange, San Luis Obispo, and Santa Barbara counties. The Santa Barbara material is diatomaceous and is of a superior quality, particularly for filtration uses which bring the higher prices. Infusorial or diatomaceous earths are also found in Fresno, Kern, Los Angeles, Plumas, San Benito, San Bernardino, San Joaquin, Shasta, Sonoma, and Tehama counties.

As over 90 per cent of the output in California is from a single operator, we have concealed the exact figures under the 'Unapportioned' item in the state and county totals. There were five operators in 1929 in Fresno, Monterey, Santa Barbara, and Shasta counties, the shipments showing a marked increase in tonnage and value compared with 1928.

The material shipped was utilized for insulation, filtration, paint pigment, cement admixture, and for clarification of gasoline and kerosene.

Total Production of Diatomaceous Earth in California.

The first recorded production of these materials in California occurred in 1889; total amount and value of output, to date, are as follows:

Year	Tons	Value	Year	Tons	Value
1889	39	$1,335	1911	2,194	$19,670
1890			1912	4,129	17,074
1891			1913	8,645	35 968
1892			1914	12,840	80,350
1893	50	2,000	1915	12,400	62,000
1894	51	2,040	1916	15,322	80,619
1895			1917	24,301	127,510
1896			1918	35,963	189,459
1897	5	200	1919	40,200	217,800
1898			1920	60,764	1,056,260
1899			1921	*90,739	1,016,675
1900			1922		
1901			1923		
1902	422	2,532	1924	*193,064	5,729,736
1903	2,703	16,015	1925		
1904	6,950	112,282	1926		
1905	3,000	15,000	1927	* 275,403	1,995,923
1906	2,430	14,400	1928		
1907	2,531	28,948	1929	*	*
1908	2,950	32,012			
1909	500	3,500	Totals	799,438	$10,876,955
1910	1,843	17,617			

* Annual details concealed under 'Unapportioned.'

DOLOMITE

Bibliography: Reports XV, XVII–XXIV (inc.). Bulletins 67, 91.

The production of dolomite in California for the year 1929 totaled 58,644 tons valued at $156,928, being an increase in both quantity and value over the 1928 figures which were 38,739 tons and $85,342. The 1929 output came from a single quarry each in Inyo, Monterey and Tuolumne counties. The material shipped was utilized for steel furnace flux and refractories, and for manufacture of CO_2. Some previously has been used for burned dolomite lime, for stucco dash-coat, and terrazzo.

Dolomite Production of California, by Years.

Previous to the 1915 statistical report of the State Mining Bureau, dolomite was included under limestone, as the two minerals are closely related chemically; but since dolomite, as such, has been found to have certain distinctive applications, we here give it a separate classification.

Amount and value of the output of dolomite, annually, have been as follows:

Year	Tons	Value
1915	4,192	$14,504
1916	13,313	46,566
1917	27,911	66,416
1918	24,560	79,441
1919	24,502	67,953
1920	42,388	132,791
1921	31,195	99,155
1922	52,409	114,911
1923	69,519	142,615
1924	28,843	71,271
1925	42.852	104,900
1926	68,6 0	119,313
1927	45 976	79 442
1928	38 379	85,342
19.9	58,644	156,928
Totals	573,323	$1,381,548

FELDSPAR

Bibliography: State Mineralogist Reports XV, XVII, XXV (inc.), XXI. Bulletins 67, 91. U. S. Bureau of Mines, Bulletin 92. Eng. & Min. Jour.-Press, Vol. 115, pp. 535-538, Mar. 24, 1923.

Feldspar was produced by five operators in three counties in California (Imperial, Riverside and San Diego) during 1929 to the amount of 13,327 short tons valued at $78,404. This was a decrease in both quantity and value as compared with the 1928 figures which were 14,628 tons and $93,745.

The requirements of the pottery trade demand that in general the percentage of free silica associated with the feldspar be less than 20 per cent, and in some cases the potters specify less than 5 per cent. An important factor, also, is the iron-bearing minerals frequently present in pegmatites and granites, such as biotite (black mica), garnet, hornblende and black tourmaline. Feldspar for pottery uses should be practically free of these. The white, potash-mica, muscovite, is not particularly objectionable except that being in thin, flexible plates, it does not readily grind to a fineness required for the feldspar.

Total Feldspar Production of California.

Total amount and value of feldspar production in California since the inception of the industry are given in the following table, by years:

Year	Tons	Value	Year	Tons	Value
1910	760	$5,720	1921	4,349	$28,343
1911	740	4,560	1922	4,587	37,109
1912	1,382	6,180	1923	11,100	81,800
1913	2,129	7,850	1924	9,055	68,112
1914	3,530	16,565	1925	8,165	59,615
1915	1,800	9,000	1926	7,300	56,400
1916	2,630	14,350	1927	10,932	86,101
1917	11,792	46,411	1928	14,628	93,745
1918	4,132	22,061	1929	13,327	78,404
1919	1,272	12,965			
1920	4,518	26,189	Totals	119,128	$761,475

FLUORSPAR

Bibliography: State Mineralogist Reports XVII, XVIII, XXIV. Bulletins 67, 91. Eng. & Min. Jour.-Press, Vol. 177, pp. 489–492, Mar. 22, 1924.

Fluorspar, or calcium fluoride, CaF_2, is one of the most important nonmetallic minerals from an industrial standpoint. About 80 per cent of the commercial mineral is prepared in the 'gravel' form and utilized as a flux in the manufacture of steel, for which use no substitute has yet been found. In the United States, under normal business conditions, the consumption for that purpose is 125,000 to 150,000 tons annually. Fluorspar is also used in aluminum smelting, and in the manufacture of enameled ware, glazed tile and brick, opalescent glass and certain chemicals, particularly hydrofluoric acid and its derivatives. The mineral is marketed in three forms: lump, gravel, and ground.

According to the U. S. Bureau of Foreign and Domestic Commerce, imports of fluorspar into the United States in 1928 amounted to 42,128 long tons, valued at $408,700, and came principally from England, with smaller amounts from British South Africa, Italy, China and Netherlands. The 1928 figures were a decrease from the previous year when 63,853 short tons worth $595,185 were imported.

In California deposits have been reported in Los Angeles, Mono, Riverside and San Bernardino counties, but no commercial production has resulted except in 1917–1918, when a total of 79 tons valued at $991 was shipped from Riverside County.

The Tariff Act of June 21, 1930, places a duty of $5.60 per ton on foreign importations of fluorspar.

Present quotations (Engineering and Mining Journal, New York) are not less than 85 per cent CaF_2 and not over 5 per cent SiO_2, $18; foundry lump, $20.

FULLER'S EARTH

Bibliography: State Mineralogist Reports XIV, XVII, XVIII, XXI, XXIII, XXV. Bulletins 38, 91. U. S. Bureau of Mines, Bulletin 71. Eng. & Min. Jour.-Press, Vol. 121, pp. 837–842, May 22, 1926.

Fuller's earth includes many kinds of unctuous clays. It is usually soft, friable, earthy, nonplastic, white and gray to dark green in color, and some varieties disintegrate in water. In California, fuller's earth has been used in clarifying both refined mineral and vegetable oils, and for special chemical purposes; although its original use was in fulling wool, as the name indicates. Production has come mainly from Calaveras and Solano counties, with other deposits noted also in Riverside, Fresno, Inyo and Kern counties.

Clays of the montmorillonite and hallosite group ('rock soap') are being utilized by some of the oil refineries in lieu of true fuller's earth in the refining of petroleum products.

The production of 15,541 short tons valued at $170,563 here credited to California for 1929 as 'fuller's earth' is in reality colloidal clay of the montmorillonite class (sold under such local names as 'bentonite,'

'otaylite,' 'shoshonite,' derived from the locality where found). Because of its being utilized for clarifying, filtering, and cleanser purposes, most of it in petroleum refining, we have placed it, for the purpose of the State Division of Mines statistical reports under the fuller's earth heading.

After all, the practical test of a fuller's earth is not so much chemical, as a physical one; that is, its physical capacity to absorb basic colors and to remove these colors from solution in animal, vegetable, or mineral oils, also from water.

The 1929 above noted shows a decrease in both amount and value from 53,323 tons and $501,743 in 1928 and came from two producers in each of the following: Inyo, Kern and San Diego counties.

The Tariff Act of June 21, 1930, placed a duty of $1.50 a ton on foreign produced imported fuller's earth.

Fuller's Earth Production of California, by Years.

Fuller's earth was first produced commercially in this state in 1899, and the total amount and value of the output since that time are as follows:

Year	Tons	Value	Year	Tons	Value
1899	620	$12,400	1916	110	$550
1900	500	3,750	1917	220	2,180
1901	1,000	19,500	1918	37	333
1902	987	19,246	1919	385	3,810
1903	250	4,750	1920	600	6,000
1904	500	9,500	1921	1,185	8,295
1905	1,344	38,000	1922	6,606	48,756
1906	440	10,500	1923	3,650	55,125
1907	100	1,000	1924	5,290	67,295
1908	50	1,000	1925	5,280	91,842
1909	459	7,385	1926	23 552	250,192
1910	340	3,820	1927	13,018	154,764
1911	466	5,294	1928	53 3 3	50',743
1912	876	6,500	1929	15,541	170,563
1913	460	3,700			
1914	760	5,928	Totals	120,649	$853,634
1915	692	4,002			

GEMS

Bibliography: State Mineralogist Reports II, XIV, XV, XVII, XVIII, XX, XXI–XXVI (inc.). Bulletins 37, 67, 91. U. S. G. S., 'Mineral Resources of the U. S.'; Bull. 603, p. 208. Bull. Dept. Geol. Univ. of Cal., Vol. 5, pp. 149–153, 331–380. Am. Jour. Sci., Vol. 31, p. 31.

The production of gem materials in California has been somewhat irregular and uncertain since 1911. The compilation of complete statistics is difficult owing to widely-scattered places at which stones are gathered and marketed for the most part in a small way. The gem material reported in California in 1929 totaled $26,850 in value compared with $22,200 in 1928. This increase is due to the demand for quartz crystals for optical uses and radio and in a smaller way to costume jewelry.

The following table shows the distribution of rough, uncut gems and jewelry material during 1929.

County	*Value*	*Kind*
Butte	$550	Diamonds, California jade, and precious serpentine.
San Bernardino	1,540	Agate, bloodstone, blue chalcedony, iceland spar, jasper, myrickite, rose-quartz and topaz.
San Diego	2,210	Kunzite, beryl, quartz, spessartite garnet, tourmaline and topaz.
Calaveras	22,550	Quartz crystals
Fresno		Topaz and green tourmaline
Inyo		Agate
Lake		Amethyst, quartz, topaz
Sonoma		Hyalite (Sonomite)
Total	$26,850	

Varieties of California's Gem Stones.

Diamonds have been found in a number of localities in California; but in every case, they have been obtained in stream gravels while working them for gold. The principal districts have been: Volcano in Amador County; Placerville, Smith's Flat and others in El Dorado County; French Corral, Nevada County; Cherokee Flat, Morris Ravine, and Yankee Hill, Butte County; Gopher Hill and upper Spanish Creek, Plumas County. The most productive district of recent years has been Cherokee in Butte County.

California *tourmalines* are decidedly distinctive in coloring and 'fire' as compared to foreign stones of this classification. The colors range from deep ruby to pink, and various shades of green, also blue.

One of our California gem stones, *benitoite*, has not been found elsewhere; and in but a single locality here: The Dallas Mine in San Benito County.

Kunzite, a gem variety of spodumene, was first found in the Pala district in San Diego County. It has thus far been found in only one locality (Madagascar) outside of California. It is of a lilac color, and is described in detail in Bulletin 37 of the State Mining Bureau.

Beryls of excellent fire and delicate colors are also obtained in the Pala district, of which the *aquamarine* (blue) and *morganite* (pink) varieties deserve special mention. Morganite, like kunzite, has thus far been found elsewhere only in Madagascar.

Californite, or 'California jade,' is a gem variety of *vesuvianite*, and is green or white in color. It is found in Butte, Fresno, and Siskiyou counties.

Stones of precious blue *topaz* of fine quality are being cut from crystals mined in northern San Diego County. They are associated with beryl and blue tourmaline.

Some *rhodonite* has been mined in Siskiyou County, and used for decorative purposes, its value being included in the marble figures.

Garnets are found in a number of localities in California; the important yield of gems being *hyacinth* and *spessartite* varieties from San Diego County.

Chrysoprase has been produced in Tulare County.

Turquoise has been found in the desert section of San Bernardino County, but none produced commercially in recent years.

Sapphires have been reported found in San Bernardino and Riverside counties, but not as yet confirmed. A few have been found in stream gravels with diamonds in Butte County.

Rubies have been identified by the laboratory of the State Mining Bureau, occurring in limestone from the Baldy Mountains, San Bernardino County. Thus far no stones of commercial size have been taken out.

Total Production of Gem Materials in California.

The value of the gem output in California annually since the beginning of commercial production is as follows:

Year	Value	Year	Value
1900	$20,500	1915	$3,565
1901	40,000	1916	4,752
1902	162,100	1917	3,049
1903	110,500	1918	650
1904	136,000	1919	5,425
1905	148,500	1920	36,056
1906	497,090	1921	10,954
1907	232,642	1922	1,312
1908	208,950	1923	13,220
1909	193,700	1924	4,800
1910	237,475	1925	10,663
1911	51,824	1926	9,049
1912	23,050	1927	7,035
1913	13,740	1928	22,200
1914	3,970	1929	26,850
		Total	$2,239,621

GRAPHITE

Bibliography: State Mineralogist Reports XIII, XIV, XV, XVII, XXV (inc.). Bulletins 67, 91. U. S. G. S., Min. Res., 1914, Pt. II.

Graphite (also called plumbago) has been produced from time to time in the state, coming principally from Sonoma and Los Angeles counties. It is difficult for these deposits, which must be concentrated, to compete with foreign supplies, which go on the market almost directly as they come from the deposit. Graphite ores are concentrated with considerable difficulty, and the electric process of manufacturing artificial graphite from coal has been perfected to such a degree that only deposits of natural graphite of a superior quality can be exploited with any certainty of success.

According to the U. S. Geological Survey, operators in this country who are working disseminated flake deposits must depend on their No. 1 and No. 2 flake for their profit. Graphite dust is merely a by-product and is salable only at a low price.

The principal value of graphite is on account of its infusibility and resistance to the action of molten metals. It is also largely used in the manufacture of electrical appliances, of 'lead' pencils, as a lubricant, as stove polish, paints, and in many other ways. Amorphous graphite, commonly carrying many impurities, brings a much lower price. For some purposes, such as foundry facings, etc., the low-grade material is satisfactory. Among the interesting uses for graphite is the prevention

of formation of scale in boilers. The action is a mechanical one. Being soft and slippery, the graphite prevents the particles of scale from adhering to one another or to the boiler and they are thus easily removed.

The price increases with the grade of material, the best quality crystalline variety being quoted at present (f. o. b. New York) at 8–9¢ per pound (Ceylon lumps).

The coarser flakes are necessary for crucibles, as they help to bind the clay together, in addition to their refractory service. Imports in 1929 from Ceylon, Canada, Madagascar, Mexico and Korea totaled 23,961 short tons, valued at $1,065,186 compared with 17,843 tons valued at $808,557 in 1928.

The Tariff Act of June 21, 1930, placed a duty on graphite or plumbago, crude or refined; Amorphous, 10% ad valorem; crystalline lump, chip or dust, 30% ad valorem; crystalline flake 1 65/100 cents per lb.

Occurrence of graphite has been reported at various times from Calaveras, Fresno, Imperial, Inyo, Los Angeles, Mendocino, San Bernardino, San Diego, Siskiyou, Sonoma and Tuolumne counties.

Graphite Production of California, by Years.

According to the records of the State Mining Bureau, the graphite production of California, by years, has been as follows:

Year	*Pounds*	*Value*
1901	128,000	$4,480
1902	84,000	1,680
1903	-------	------
1913	2,500	25
1914	-------	------
1915	-------	------
1916	29,190	2,335
1917		
1918	*770,000	37,225
1919		
1920		
1921		
1922	*624,000	26,160
1923	-------	------
1925		
1926	*76,000	13,120
1927		
1928	-------	------
1929	-------	------
Totals	2,113,690	$85,025

* Annual details concealed under 'Unapportioned,' on account of a single producer.

GYPSUM

Bibliography: State Mineralogist Reports XIV, XV, XVII, XVIII, XXII, XXIII, XXV. Bulletins 38, 67, 91. U. S. Geol. Surv., Bull. 223, 413, 430, 697. U. S. Bur. of Standards, Circular No. 281.

During 1929 there were shipments of gypsum in California amounting to 140,844 tons valued at $396,951, which was an increase in both quantity and value over the output of 1928, which was 104,790 tons and $200,567. The 1929 output came from one producer in Imperial county and three in Riverside county.

Uses.

The most important use of gypsum from the quantity standpoint is in the calcined form where it is utilized in the manufacture of various

hard-wall plasters and plaster board. As plaster of paris, it plays a very important part in surgical work. Approximately 2%, by weight, raw gypsum is added in the manufacture of Portland cement just before the final grinding. In this application, the gypsum acts as a retarder to the set of the cement. The use of gypsum tile for non-bearing fireproof partitions, stairway and elevator enclosures, and the protection of steel columns, girders and beams, has increased greatly.

Keene's cement is a gypsum product, calcined to complete dehydration, and an accelerator added such as alum, potassium sulphate, borax, aluminum sulphate.

Land plaster may be applied to the soil by drilling, or scattered in the hill, or it may be sowed broadcast, in quantities ranging from 200 to 500 pounds to the acre.

Gypsum Mine of U. S. Gypsum Company, near Blythe, Riverside County. Photo by Walter W. Bradley.

Total Production of Gypsum in California.

Production of gypsum annually in California since such records have been compiled by this Bureau is as follows:

Year	Tons	Value	Year	Tons	Value
1887	2,700	$27,000	1910	45,294	$129,152
1888	2,500	25,000	1911	31,457	101,475
1889	3,000	30,000	1912	37,529	117,388
1890	3,000	30,000	1913	47,100	135,050
1891	2,000	20,000	1914	29,734	78,375
1892	2,000	20,000	1915	20,200	48,953
1893	1,620	14,280	1916	33,384	59,533
1894	2,446	24,584	1917	30,825	56,840
1895	5,158	51,014	1918	19,695	37,176
1896	1,310	12,580	1919	19,813	50,579
1897	2,200	19,250	1920	20,507	92,535
1898	3,100	23,600	1921	37,412	78,875
1899	3,663	14,950	1922	47,084	188,336
1900	2,522	10,088	1923	86,410	289,136
1901	3,875	38,750	1924	25,569	53,210
1902	10 200	53,500	1925	107,613	172,444
1903	6,914	46,441	1926	114,868	211,337
1904	3,350	56,592	1927	94,630	292,090
1905	12,859	54,500	1928	104.790	200,567
1906	21,000	69,000	1929	140,844	396,' 51
1907	8,900	57,700			
1908	34,600	155,400	Totals	1,269,366	$3,782,407
1909	30,700	138,176			

LIMESTONE

Bibliography: State Mineralogist Reports IV, XII–XV (inc.), XVII–XXVI (inc.). Bulletins 38, 91. Oregon Agr. College Extension Bulletin 305. Eng. and Min. Jour.-Press, Vol. 120, pp. 249–253.

'Industrial' limestone was produced in 12 counties in California during 1929 to the amount of 168,315 short tons valued at 557,617, being an increase in both quantity and value compared with the 1928 figures which were 127,895 tons worth $397,935.

The amount here given does not include the limestone used in the manufacture of cement nor for macadam and concrete, nor of lime for building purposes; but accounts for that utilized as a smelter and foundry flux, for glass and sugar making, and other special chemical and manufacturing processes. It also includes that utilized for fertilizers (agricultural 'lime'), 'roofing gravel,' paint and concrete filler, whiting for paint, putty, kalsomine, terrazzo, paving dust, chicken grit, carbon dioxide gas, 'paving compound,' facing dust for concrete pipe, also for rubber and magnesite mix. That from Santa Clara and Los Angeles counties is calcareous marl sold for agricultural purposes. Of the total 'industrial' limestone produced in 1929 approximately 40,037 tons valued at $145,081 were used for agricultural purposes.

Distribution of 1929 output of limestone was as follows:

County	*Amount*	*Value*
Butte	976	$4,108
El Dorado	71,033	199,989
San Bernardino	15,526	40,753
Santa Cruz	15,143	40,786
Siskiyou	298	3,152
Inyo, Los Angeles, San Mateo, Santa Clara, Tulare, Tuolumne, Ventura *	65,339	268,829
Totals	168,315	$557,617

* Combined to conceal the output of a single operator in each.

Limestone Production of California, by Years.

The following tabulation gives the amounts and value of 'industrial' limestone produced in California by years since 1894 when compilation of such records was begun by the State Mining Bureau. These tonnages consist principally of limestone utilized for flux, glass and sugar making, agricultural, chemical, and other special industrial purposes. That utilized in cement manufacture is not included:

Year	Tons	Value	Year	Tons	Value
1894	15,420	$19,275	1912	613,375	$570,248
1895	71,355	71,690	1913	301,918	274,455
1896	68,184	71,112	1914	572,272	517,713
1897	36,796	38,556	1915	146,324	156,288
1898	27,686	24,548	1916	187,521	217,733
1899	30,769	29,185	1917	237,279	356,396
1900	32,791	31,532	1918	208,566	456,258
1901	76,937	99,445	1919	88,291	248,145
1902	71,422	90,524	1920	90,120	298,197
1903	125,919	163,988	1921	75,921	305,912
1904	40,207	87,207	1922	84,382	282,181
1905	192,749	323,325	1923	143,266	348,464
1906	80,262	162,827	1924	219,476	582,660
1907	230,985	406,041	1925	319,977	494,525
1908	273,890	297,264	1926	108,795	367,501
1909	337,676	419,921	1927	699 790	663,957
1910	684,635	581,208	1928	127,895	397.935
1911	516,398	452,790	1929	168,315	557,617
			Totals	7,307,564	$10,466,623

LITHIA

Bibliography: State Mineralogist Reports II, IV, XIV, XXI. Bulletins 38, 67, 91.

Lithia mica, lepidolite (a silicate of lithium and others) utilized in the manufacture of artificial mineral water, fireworks, glass, etc., has been mined in San Diego County since 1899, except between 1905 and 1915, though there was none shipped in 1923, 1925, and 1929. During 1929 there was a small amount of lepidolite mined in California, but none shipped. Some amblygonite, a lithium phosphate, is occasionally also obtained from pockets associated with the gem tourmalines.

Lithia mica total production in the state has been as follows:

Year	Tons	Value	Year	Tons	Value
1899	124	$4,600	1920	10,046	$153,502
1900	440	11,000	1921	*1,365	20,781
1901	1,100	27,500	1922		
1902	822	31,880	1923		
1903	700	27,300	1924	109	2,269
1904	641	25,000	1925		
1905	25	276	1926		
1906			1927	*550	13,900
1915	91	1,365	1928		
1916	71	1,065	1929		
1917	880	8,800			
1918	4,111	73,998	Totals	21,875	$417,636
1919	800	14,400			

* Annual details concealed under 'Unapportioned.'

MICA

Bibliography: State Mineralogist Reports II, IV. Bulletins 38, 67, 91. U. S. Geol. Surv., Bull. 740; Min. Res. of U. S. Eng. & Min. Jour.-Press, Vol. 115, pp. 55–60, Jan. 13, 1923.

Sericite, a very fine-grained variety of muscovite, was shipped from Imperial County during 1929. This is the first commercial production

of this material in California. This type of material is used as a cheap grade of ground mica for roofing, as a refractory and decorative material to imitate snow.

Production of mica in California has been as follows:

Year	Tons	Value
1902	50	$2,500
1903	50	3,800
1904	50	3,000
1929	*	*
Totals	150	$9,300

* Annual details concealed under 'Unapportioned.'

Classification and Uses.

Practically all marketable mica is of the muscovite or phlogopite varieties. There are three main commercial classes: Sheet mica, including punch; splittings, and scrap. Sheet mica is used chiefly for electrical purposes and for glazing; splittings are made into built-up mica; scrap is ground to a powder. Mica to be classified as sheet must yield a rectangle of at least 1½ x 2 in., must split evenly and freely, be free from cracks, rulings, or plications, and reasonably free from inclusions of foreign matter, though stains of a nonconducting character are permissible for some uses. Ability to withstand heat and high electrical resistance have led to a wide application of sheet mica in the electrical industries. The electrical uses of sheet mica greatly exceed all others in quantity and value of the material used.

As a heat-resisting transparent medium, sheet mica has various uses. It is widely employed for stove windows, though this use has declined to a considerable extent. A hard and rigid mica that is nearly clear is best suited for stove fronts. High-grade stove mica commands a higher price than electrical mica, because for the most part larger sizes are demanded. Mica is also used in furnace and bake-oven sight-holes, heat screens, lamp chimneys, canopies and shades, particularly for gas mantels, and also for military lanterns and in lantern slides.

Its ability to withstand shocks and strains, combined with its transparency, has led to wide use in motor goggles, spectacles, drivers' helmets, smoke helmets, compass cards, gage fronts, and in windows subject to shock, as in the conning towers of warships. On account of its heat-resisting qualities, ground mica is used in railroad car axle packings, in pipe and boiler coverings, in fireproof paints, and in rubber tires. Ground mica is used as a component in roofing, as a filler in rubber and other products, in calico printing, and as a tire powder. It is used also in tinsel decorations, and as 'Santa Claus snow' for Christmas tree and window decorations. It is used as a lubricant for wooden bearings, and mixed with oil for metal bearings.

MINERAL PAINT

Bibliography: State Mineralogist Reports XII–XIX (inc.), XXI, XXII–XXVI (inc.). Bulletins 38, 91.

Mineral paint materials were produced in California in 1929 from a single operator each in Alameda, Placer, and Stanislaus counties, amounting to 467 short tons valued at $2,820. This was a decrease in both quantity and value from the 1928 production which was placed under 'Unapportioned' to conceal the output of either of the two operators of that year.

There has been a steady production of mineral paint in California since 1890, when the first recorded production was made. This material came from Alameda, Amador, Butte, Calaveras, Colusa, Los Angeles, Napa, Nevada, Placer, Riverside, Shasta, Sonoma, Stanislaus and Ventura counties. There are also other deposits that may have possible commercial value, but as yet there have been no commercial shipments from El Dorado, Imperial, Kern, Kings, Lake, Mendocino, San Diego, Siskiyou, Trinity and Yuba counties, in which they are found.

California mineral paints have been used as the color pigments in mortar, stucco, and cement mixes in kalsomine, pigments in oil paint, various fillers, in lineoleum, in cosmetics, etc. Their colors vary greatly, as also their composition; yellow, the most common, is colored by limonite; red is colored from hematite; the browns might be colored with either or both hematite or limonite, all of which are mixed with more or less clay. There are several plants in the state that treat their ochers, and blend them to give uniform colors and quality at all times. The color of the materials as they come from the mine will vary, but when properly handled a uniform quality and color can be maintained.

These deposits are found either as soft fine-grained red shales, as gossan after sulphide ore bodies, as yellow or brown clays colored by water carrying iron in solution and depositing it on the clay or from spring waters high in iron which deposit an iron oxide or hydroxide.

Besides the natural deposits, tailings from chlorination plants, pyrite sinter from acid works and magnetite concentrated from black sand have been used in the manufacture of synthetic ochers.

Mineral Paint Production of California, by Years.

The first recorded production of mineral paint materials in the state was in the year 1890. The output, showing annual amount and value since that time, is given herewith:

Year	Tons	Value	Year	Tons	Value
1890	40	$480	1910	200	$2,040
1891	22	880	1911	186	1,184
1892	25	750	1912	300	1,800
1893	590	26,795	1913	303	1,780
1894	610	14,140	1914	132	847
1895	750	8,425	1915	311	1,756
1896	395	5,540	1916	643	3,960
1897	578	8,165	1917	520	2,700
1898	653	9,698	1918	728	4,738
1899	1,704	20,294	1919	1,780	17,055
1900	529	3,993	1920	779	8,477
1901	325	875	1921	446	4,748
1902	589	1,533	1922	1,620	13,277
1903	2,370	3,720	1923	1,049	11,773
1904	270	1,985	1924	532	5,234
1905	754	4,025	1925	669	6,969
1906	250	1,720	1926	569	5,846
1907	250	1,720	1927		
1908	335	2,250	1928	* 919	9,592
1909	305	2,325	1929	467	2,820
			Totals	22,897	$219,098

*Under 'Unapportioned.'

MINERAL WATER

Bibliography: State Mineralogist Reports VI, XII–XVIII (inc.), XXI–XXIII (inc.). U. S. G. S., Water Supply Paper 338.

Min. Res, 1914, 1916. 'Mineral Springs and Health Resorts of California,' by Dr. Winslow Anderson, 1890. U. S. Dept. of Agr., Bur. of Chem., Bulletin 91.

A widespread production of mineral water is shown annually in California. These figures refer to mineral water actually bottled for sale, or for local consumption. Water from some of the springs having a special medicinal value brings a price many times higher than the average shown, while in some cases the water is used merely for drinking purposes and sells for a nominal figure. Health and pleasure resorts are located at many of the springs. The waters of some of the hot springs are not suitable for drinking, but are very efficacious for bathing.

From a therapeutic standpoint, California is particularly rich in mineral springs. The counterparts of many of the world-famed spas

Steam wells at Calistoga, Napa County.

of Europe and the eastern United States can be found here. Radioactivity has been noted in at least three localities in California: At The Geysers in Sonoma County, Arrowhead Hot Springs in San Bernardino County, and Paraiso Springs, Monterey County. It doubtless exists at others, but the State Division of Mines has not as yet had funds available to conduct the necessary investigations along this line.

So far as the efficacy of radioactivity in mineral water is concerned, it has been found by investigations of the U. S. Geological Survey and the U. S. Department of Agriculture that it is not retained and transported in bottled water. Radioactivity in water is only temporary, and dissipates. To obtain whatever therapeutic effect it may possess, radioactive water should be utilized directly at the spring.

Commercial production of mineral water in California for 1929 amounted to 27,032,083 gallons valued at $2,040,615, being the largest annual output in both quantity and value recorded in the state. The 1928 production amounted to 25,049,002 gallons and $1,304,969. The 1929 output was distributed by counties as follows:

County	*Gallons*	*Value*
Butte	2,250	$1,175
Lake	30,965	22,100
Los Angeles	12,525,565	1,076,504
Napa	86,141	90,703
San Diego	24,410	75,246
Santa Clara	10,760	1,076
Sonoma	20,701	7,376
Calaveras, Contra Costa, Fresno, Marin, Riverside, San Bernardino, San Luis Obispo, Santa Barbara, Siskiyou, Solano, *	14,331,291	766,485
Totals	27,032,083	$2,040,615

*Combined to conceal output of a single operation in each.

The production above tabulated either came from springs or artesian wells, and was bottled, in part with artificial carbonation, but mostly natural, and sold for drinking purposes. A large part was used in the preparation of soft drinks with flavors.

Although some of the operators complain that prohibition has all but killed off the mineral water business, the reports of actual production of mineral water bottled and sold indicate an encouraging growth and a material increase annually both in total quantity and value, as may be noted from the tabulation below, with the exception of 1928, which shows a decreased value, although an increased quantity.

Mineral Water Production of California, by Years.

Mineral water was bottled for sale, at the Napa Soda Springs, Napa County, as early as 1860, and at other springs in California, notably The Geysers, Sonoma County, also at early dates; but there are no figures available earlier than the year 1887. Amounts and values, annually, since that year are shown herewith:

Year	Gallons	Value	Year	Gallons	Value
1887	618,162	$144,368	1909	2,449,834	$465,488
1888	1,112,202	252,990	1910	2,335,259	522,009
1889	808,625	252,241	1911	2,637,669	590,654
1890	258,722	89,786	1912	2,497,794	529,384
1891	334,553	139,959	1913	2,350,792	599,748
1892	331,875	162,019	1914	2,443,572	476,169
1893	383,179	90,667	1915	2,274,267	467,738
1894	402,275	184,481	1916	2,273,817	410,112
1895	701,397	291,500	1917	1,942,020	340,566
1896	808,843	337,434	1918	1,808,791	375,650
1897	1,508,192	345,863	1919	2,233,842	340,117
1898	1,429,809	213,817	1920	2,391,791	421,643
1899	1,338,537	406,691	1921	3,446,278	367,476
1900	2,456,115	268,607	1922	4,276,346	486,424
1901	1,555,328	559,057	1923	5,487,276	616,919
1902	1,701,142	612,477	1924	8,159,211	818,726
1903	2,056,340	558,201	1925	12,115,072	1,230,455
1904	2,430,320	496,946	1926	14,074,877	1,171,550
1905	2,194,150	538,700	1927	16,644,423	1,487,183
1906	1,585,690	478,186	1928	25,049,002	1,304,969
1907	2,924,269	544,016	1929	27,032,083	2,040,615
1908	2,789,715	560,507	Totals	173,653,456	$22,692,107

PHOSPHATES

Bibliography: State Mineralogist Report XXI. Bulletins 67, 91.

No commercial production of phosphates has been recorded from California, though occasional pockets of the lithium phosphate, amblygonite, Li (AlF) PO_4, have been found associated with the gem tourmaline deposits in San Diego County. Such production has been classified under lithia.

PUMICE and VOLCANIC ASH

Bibliography: State Mineralogist Reports XII, XIV, XV, XVII, XVIII, XXII–XXV (inc.). Bulletin 38. (See 'Tufa.')

The production of pumice and volcanic ash in California for the year 1929 amounted to 10,449 short tons valued at $76,123 coming from two operators in Fresno County and a single property each in Kern, Imperial, Inyo, Mono, San Bernardino and San Luis Obispo counties. The 1929 production was approximated the same as the 1928, but showed a decreased value. The figures were 10,440 and 105,055.

The material from Imperial, Inyo and Mono is the viscular, block variety and was sold for abrasive purposes. The balance of the Mono material and that from Fresno, Kern and San Luis Obispo was the volcanic ash, or tuff variety, and was employed in making soap, cleanser compounds, and a large tonnage is being utilized as a concrete filler in cement displacement. The Kern county ash is going into the preparation of one of the popular and nationally advertised brands of cleanser compounds.

Pumice Production of California, by Years.

Commercial production of pumice in California was first reported to the State Mining Bureau in 1909, then not again until 1912, since which year there has been a small annual output, as indicated by the following table:

Year	Tons	Value	Year	Tons	Value
1909	50	$500	1920	1,537	$25,890
1910			1921	406	6,310
1911			1922	613	4,248
1912	100	2,500	1923	2,936	16,309
1913	3,590	4,500	1924	4,919	33,404
1914	50	1,000	1925	5,319	32,937
1915	380	6,400	1926	7,170	48,350
1916	1,246	18,092	1927	13,779	168,896
1917	525	5,295	1928	10,440	105,055
1918	2,114	28,669	1929	10,449	76,123
1919	2,388	43,657			
			Totals	68,011	$628,135

PYRITES

Bibliography: State Mineralogist Reports XVIII, XIX, XXII, XXV, Bulletins 38, 91. Min. and Sci. Press, Vol. 144, pp. 825, 840.

A total production of 79,169 tons of pyrite valued at $363,717 was reported shipped in California during 1929, from properties in Alameda and Shasta counties. This was a decrease both in quantity and value from 1928 figures of 90,566 tons and $400,627.

The material was mostly used in the manufacture of sulphuric acid for explosives and fertilizers, but a portion was utilized directly in the preparation of agricultural fertilizer and insecticide. The sulphur content ranged up to 46.5 per cent S.

This does not include the large quantities of pyrite, chalcopyrite, and other sulphides which are otherwise treated for their valuable metal contents. Some sulphuric acid is annually made as a by-product

in the course of roasting certain tonnages of Mother Lode auriferous concentrates while under treatment for their precious metal values.

Pyrites Production in California, by Years.

The total recorded pyrites production in California to date is as follows:

Year	Tons	Value	Year	Tons	Value
1898	6,000	$30,000	1915	92,462	293,148
1899	5,400	28,620	1916	120,525	372,969
1900	3,612	21,133	1917	111,325	323,704
1901	4,578	18,429	1918	128,329	425,012
1902	17,525	60,306	1919	147,024	540,300
1903	24,311	94,000	1920	146,001	530,581
1904	15,043	62,992	1921	110,025	473,735
1905	15,503	63,958	1922	151,381	570,425
1906	46,689	145,895	1923	148,004	555,308
1907	82,270	251,774	1924	124,214	517,835
1908	107,081	610,335	1925	129,500	528,550
1909	457,867	1,389,802	1926	100,896	466,088
1910	42,621	179,862	1927	130,910	564,823
1911	54,225	182,954	1928	90,566	400,627
1912	69,872	203,470	1929	79,169	363,717
1913	79,000	218,537			
1914	79,267	230,058	Totals	2,920,225	10,718,997

SHALE OIL

Bibliography: State Mineralogist Report XIX. U. S. Geol. Surv., Bulletins 322, 729. U. S. Bur. of Mines, Bull. 210. Eng. and Min. Jour.-Press, Vol. 118, No. 8, pp. 290–292, Aug. 23, 1924. Chem. & Met. Eng., Vol. 32, No. 6, Feb., 1925. Min. Congress Jour., Dec., 1924.

Oil shale is defined by Gavin,[1] as follows:

"Oil shale is a compact, laminated rock of sedimentary origin, yielding over 33 per cent of ash and containing organic matter that yields oil when distilled, but not appreciably when extracted with the ordinary solvents for petroleum."

* * * * * * *

"Oil shales contain a substance, or substances, usually classed as a pyro-bitumen, that by destructive distillation, or pyrolysis, yields oils somewhat similar to petroleum. These substances have been termed 'kerogen,' from two Greek words meaning producer of wax."

The Scottish oil shales are also known as 'torbanite.'

The so-called 'oil shales' of California do not for the most part conform to the above definition, as the greater part of the oil obtained from them occurs as such and can be extracted by suitable solvents. The most extensive deposits in this state are part of the Monterey formation of Tertiary age, and physically and chemically are different from the oil shales of Scotland and from other oil shales in the United States. The mineral matter of this shale is diatomaceous; the beds that yield oil occur in massive formation; and when freshly broken smell strongly of petroleum. Most geologists consider the Monterey shales to have been the origin of the oil in some of the oil fields of California.

Although the extraction of shale oil has been a matter of commercial practice on a considerable scale for many years in Scotland, France, and Australia, it has not attained any great commercial importance

[1] Gavin, M. J., Oil Shale, An Historical, Technical, and Economic Study: U. S. Bur. of Mines, Bull. 210, p. 26, 1924.

as yet in the United States. Technical knowledge of the subject, however, is increasing. With the gradual depletion of the underground reserves of liquid oil, it is merely a matter of time until the development of the oil shales of the United States will be an economic necessity. The selling price of petroleum will be the determining factor. The recovery of by-product ammonium sulphate is an important feature of the process.

Two plants on a more or less experimental scale have been in operation in California for several years past, with commercial production beginning in a small way in 1922. The product, in part, has been sold for utilization as a flotation oil in metallurgical work, and part has been consumed as fuel at the plants. There was no production reported for 1929. As only one plant reported output for 1927, the value is concealed under the 'Unapportioned' item.

Shale Oil Production of California, by Years

Year	*Barrels*	*Value*
1922, 1923*	4,333	$44,262
1924, 1925*	8,688	55,240
1926, 1927*	8,819	9,998
1928	----	----
Totals	21,840	$109,500

* Annual details concealed under 'Unapportioned.'

SILICA (Sand and Quartz)

Bioliography: State Mineralogist Reports IX, XIV, XV, XVII, XVIII, XX–XXIII. Bulletins 38, 67, 91.

We combine these materials because of the overlapping roles of vein quartz which is mined for use in glass making and as an abrasive, and that of silica sand which, although mainly utilized in glass manufacture, also serves as an abrasive. Both varieties are also utilized to some extent in fire-brick manufacture.

A portion of the tonnage of vein quartz in California in 1916 and 1917 was employed in the preparation of ferro-silicon by the electric furnace. At present, some is utilized as a foundary flux, and for steel-casting molds. A portion of the silica sold (both sand and quartz) is also used in glazes for procelain, pottery and tile, and in the body of the ware to diminish shrinkage; and some of the sand for the preparation of sodium silicate ('water glass'). Manufacturers of paint use finely-ground silica, which forms as much as one-third of the total pigment in some paints. For certain purposes finely-ground crystalline material is superior in paints to other materials because of the angularity of the grains, which makes them adhere more firmly to the article painted and after wear afford a good surface for repainting. The same angularity makes artifically comminuted crystalline quartz superior to natural sand for use in wood fillers. It is also preferable for soaps and polishing powders. Part of the 1925 output was used for roofing and stucco-dash granules.

We do not include under this heading such forms of silica as: quartzite, sandstone, flint, tripoli, diatomaceous earth, nor the gem forms of 'rock crystal,' amethyst, and opal. Each of these has various industrial uses, which are treated under their own designations.

The production of silica in California in 1929 amounted to 18,686 tons, valued at $79,210, from ten properties in eight counties, Contra Costa, El Dorado, Imperial, Mariposa, Monterey, Placer, Riverside and San Diego. This was an increase from 14,814 tons valued at $66,679 in 1928. Of the above total 9656 tons was of sand and 9030 tons of vein and boulder quartz. For making the higher grades of glass, most of the sand is imported from Belgium. Belgium sand has also displaced local material in the manufacture of sodium silicate ('water glass'). There are various deposits of quartz in California which could be utilized for glass making, but to date they have not been so used owing to the cost of grinding and the difficulty of preventing contamination by iron while grinding.

Silica sand has been produced in the following counties of the state: Alameda, Amador, Contra Costa, El Dorado, Imperial, Los Angeles, Mariposa, Mono, Monterey, Orange, Placer, Riverside, San Diego, San Joaquin and Tulare, the chief centers being Amador, Monterey and Los Angeles counties. The industry is of limited importance, so far, because of the fact that much of the available material is not of a grade which will produce first-class colorless glass; for such, it must be essentially iron-free. Even a fractional per cent of iron imparts a green color to the glass.

The Tariff Act of June 21, 1930, placed a duty on sand, containing 95 per cent or more of *Silica* and not more than six-tenths of 1 per cent of oxide of iron and suitable for use in the manufacture of glass, of $2 per ton.

Total Silica Production in California.

Total silica production in California since the inception of the industry, in 1899, is shown below, being mainly sand:

Year	Tons	Value	Year	Tons	Value
1899	3,000	$3,500	1915	28,904	$34,322
1900	2,200	2,200	1916	20,880	48,908
1901	5,000	16,250	1917	19,376	41,166
1902	4,500	12,225	1918	23,257	88,930
1903	7,725	7,525	1919	18,659	101,600
1904	10,004	12,276	1920	25,324	96,793
1905	9,257	8,121	1921	10,569	49,179
1906	9,750	13,375	1922	9,874	31,016
1907	11,065	8,178	1923	7,964	30,420
1908	9,255	22,045	1924	6,808	35,006
1909	12,259	25,517	1925	12,498	96,780
1910	19,224	18,265	1926	30,010	104,317
1911	8,620	8,672	1927	24,636	94,762
1912	13,075	15,404	1928	14 814	66 679
1913	18,618	21,899	1929	18,686	79,210
1914	28.538	22,688	Totals	444,349	$1,207,228

SILLIMANITE—ANDALUSITE—CYANITE GROUP

Bibliography: State Mineralogist Reports XX, XXIII, XXIV. Bulletins 67, 91. Dana's Mineralogy. U. S. Geol. Surv., Prof. Paper 110. U. S. Bureau of Mines Inform. Circ. 6255. Eng.

& Min. Jour.-Press, Vol. 120, pp. 91–94, 1925. Amer. Mineralogist, June, 1924.

Sillimanite and andalusite are both aluminum silicates (Al_2SiO_5), having the same composition and formula, but with slightly different physical characteristics. Though both crystallize in the orthorhombic system, their crystal habits are different, andalusite being usually in coarse prismatic forms, the prisms nearly square in shape; also occurs massive, imperfectly columnar, and sometimes radiated and granular. Sillimanite commonly occurs in long, slender crystals, not distinctly terminated; prismatic faces striated and rounded; often in close parallel groups, passing into fibrous and columnar massive forms, sometimes radiating. Colors are similar. Hardness, andalusite 7.5, sillimanite 6–7. Andalusite is slightly lighter in specific gravity.

A massive deposit of andalusite, found in Dry Creek Canyon in the White Mountains of the Inyo Range, in Mono County, is being mined by the Champion Porcelain Company of Detroit, Michigan. The material is shipped East and utilized in the manufacture of porcelain for automobile spark plugs, for other high-tension electric insulators, laboratory ware and porcelain. Porcelain made from these minerals can be subjected to sudden and extreme changes in temperature without damage.

Cyanite is also an aluminum silicate (Al_2SiO_5), of the same chemical composition as andalusite and sillimanite, but crystallizing in the triclinic system. Occurs usually in long-bladed crystals, rarely terminated; hardness 5-7.25; gravity 3.56-3.67 (being heavier than the other two); color, blue. A deposit of cyanite, apparently in quantity, is being developed in Imperial County, near Ogilby, and shipments made to a refractory plant in Los Angeles.

Dumortierite, though differing somewhat in composition from the above, being a basic aluminum silicate ($HAl_8BSi_3O_{20}$), has proved similar in behavior in ceramic work so that it is now being mixed with andalusite for electrical procelains. A deposit of this mineral in Nevada is being mined for that purpose. Occurrences of massive dumortierite are known in Imperial and San Diego counties in this state and there may yet be some commercial possibilities for them.

Total Sillimanite Group Production of California, by Years

Year	*Tons*	*Value*
1922 1923 1924 *	4,584	$98,790
1925 1926 *	4,810	203,000
1927 1928 *	4,276	76,000
1929	*	*
Totals	13,670	$377,790

* Annual details concealed under 'Unapportioned.'

SOAPSTONE and TALC

Bibliography: State Mineralogist Reports XII, XIV, XV, XVII–XXV (inc.). Bulletins 38, 67, 91. U. S. Bur. of Mines, Bulletin 213. Rep. of Investigations, Serial No. 2253, May, 1921.

The total output of talc and soapstone in California in 1929 amounted to 18,676 tons valued at $193,493. Although the tonnage was approxi-

mately the same, the value showed a decrease from the 1928 output, which was 18,668 tons and $251,372. Over 75% of the product was high-grade talc from Inyo and San Bernardino counties, which material was utilized mainly in toilet powders, paint, paper and rubber manufacture, and some in ceramics. The remainder came from Butte, El Dorado and Los Angeles counties, being soapstone, with some of the El Dorado material, a steatite variety, used in making electrical insulators. Inyo County has three producers; Butte and San Bernardino counties, two producers each; El Dorado County a single producer.

The 'soapstone' grades were used mainly for roofing granules and as a filler in roofing paper, and part also in magnesite cement.

It is reported that Californian talc is replacing imported talc in the toilet trade on the basis of quality. The largest production of talc in the United States comes from Vermont and New York, and of massive soapstone from Virginia.

Composition and Varieties.

Talc is hydrous magnesium silicate with the chemical formula $H_2Mg_3(SiO_3)_4$. It is also called soapstone and steatite. The term 'talc' properly includes all forms of the pure mineral, whereas 'steatite' denotes particularly the massive, compact variety, and 'soapstone' the impure, massive forms containing as low as 50% of talc. When pure, talc is soft, having a hardness of 1, but impurities increase the hardness up to 3 or 4. The color varies from pure white and silvery white through gray, green, apple green, to dark green, also yellow, brown, and reddish when impure. It is commonly compact or massive, or in fine granular aggregates, and often in foliated plates or in fibrous aggregates.

Uses.

Although the uses of talc and soapstone are many and varied, some of them are not in general well known nor fully developed; and although few of their uses can justly be considered essential in the sense that no substitute can be used, there are several which are of great importance. The widest use of talc is in the powdered form, and the value depends upon color (whiteness), uniformity, fineness of grain, freedom from grit, 'slip,' and sometimes freedom from lime. The white varieties, free from grit and iron, low in lime, ground to 200-mesh and finer, are largely used as a filler for paper, rubber and paint, and the very highest grade as toilet powder. Ground talc is also used in dressing and coating cloth, in making soap, rope, twine, pipe-covering compounds, heavy lubricants, and polishes, and as a filler in concrete to make it waterproof. Ground talc and soapstone are used for foundry facings, either alone or mixed with graphite and a coarser grade is used in the manufacture of asphalt-coated roofing felts and papers, both as a filler and as a surfacing. Massive close-grained talc, free from iron and grit, is cut into blanks and baked, forming the material used for gas tips and electrical insulation, commonly known as 'lava.' Its hardness, its resistance to heat, acids and alkalies, and its great dielectric strength make it very useful for electric insulation, and no satisfactory substitute for it has been found.

Massive varieties of talc, pyrophyllite, and high grades of soapstone are cut into slate pencils and steel-workers' crayons. 'French chalk'

or 'tailor's chalk' is a soft, massive talc. In China, Japan and India, massive talc (steatite) is carved into grotesque images and other forms, and is often sold as imitation jade. Soapstone is cut into slabs of 1 and 2 inches in thickness and sold as griddles, footwarmers, and fireless-cooker stones, or fabricated into laundry sinks and tubs, laboratory-table tops, hoods, tanks and sinks, electric switchboards, and for other uses in which the properties of resistance to heat, acids and alkalies, and electricity are essential.

Imports.

Foreign importations of high-grade white talc suitable for the manufacture of toilet powder have come mainly from Canada, Italy and France. Foreign producers have the benefit of cheap labor, and a low tariff import duty. In addition to these disadvantages, California operators have to contend with transcontinental freight rates to the eastern manufacturing centers. In 1929 importations totaled 31,247 short tons, valued at $671,310, compared with 27,008 tons, valued at $576,454 in 1928, according to the United States Bureau of Foreign and Domestic Commerce.

The Tariff Act of 1930 places a duty on talc, steatite or soapstone and French chalk; crude or unground of one-fourth of one cent per pound.

Talc Production of California, by Years.

Production was intermittent in the state up to 1912; but there has been a material growth since 1916, as shown in the following table:

Year	Tons	Value	Year	Tons	Value
1893	400	$17,750	1912	1,750	$7,350
1894			1913	1,350	6,150
1895	25	375	1914	1,000	4,500
1896			1915	1,663	14,750
1897			1916	1,703	9,831
1898			1917	5,267	45,279
1899			1918	11,760	85,534
1900			1919	8,764	115,091
1901	10	119	1920	11,327	221,362
1902	14	288	1921	8,752	130,078
1903	219	10,124	1922	13,378	197,186
1904	228	2,315	1923	17,439	252,631
1905	300	3,000	1924	16,179	242,770
1906			1925	15,465	239,084
1907			1926	17,004	255,645
1908	3	48	1927	16,218	164,744
1909	33	280	1928	18,668	251,372
1910	740	7,260	1929	18,676	193,493
1911			Totals	188,335	$2,478,439

STRONTIUM

Bibliography: Bulletins 67, 91. U. S. G. S., Bull. 540; 660–I.

There has been no production of strontium minerals in California since 1918, though in that year both celestite ($SrSO_4$), and the carbonate, strontianite ($SrCO_3$) were shipped. The first recorded commercial output of strontium minerals in California was in 1916. The occurrence of the carbonate is particularly interesting and valuable, as it appears to be the only considerable deposit of commercial importance so far opened up in the United States. Shipments reported as averaging 80% $SrCO_3$ have been made. The deposit is associated with

deposits of barite near Barstow, San Bernardino County. The carbonate has also been found in massive form near Shoshone, Inyo County. In addition to Imperial County, celestite is found near Calico and Ludlow, and in the Avawatz Mountains in San Bernardino County, but as yet undeveloped.

Production of strontium minerals in California, by years, has been as follows:

Year	Tons	Value
1916	57	$2,850
1917	3,050	37,000
1918	2,900	33,000
1919		
Totals	6,007	$72,850

The principal use for strontium in the United States is in the form of the nitrate in the manufacture of red flares, or Costen and Bengal lights and fireworks. It is imported mainly from Germany and England. In Germany and Russia, strontium in the form of the hydroxide is used in the manufacture of beet sugar. It is stated that strontia is more efficient and satisfactory in that process than lime, as it gives an additional recovery of 6% to 8%.

Of the two minerals, strontianite (carbonate) and celestite (sulphate), the carbonate is the more desirable, as it is easier to convert to other salts; but it is scarcer. Celestite is found with limestone and sandstone and is sometimes associated with gypsum. Strontianite is also found with limestone, but associated with barite and calcite.

SULPHUR

Bibliography: State Mineralogist Reports IV, XIII, XIV, XXV. Bulletins 38, 67, 91.

During 1929 there was a small production of sulphur rock in California. This material came from Colusa County and was utilized in the manufacture of a fertilizer and in dusting for mildew. This was the first commercial output of native sulphur for several years, the last previous production was in 1923 and 1924 and came from Kern County. This mineral has been found to some extent in Colusa, Imperial, Inyo, Kern, Lake, Sonoma, Tehama, and Ventura counties.

The most important use of sulphur is in the making of sulphuric acid used in turn in manufacture of superphosphate fertilizers, chemicals, dyes and explosives; in steel pickling and galvanizing; refining of petroleum, in sugar industry, in storage battery and many other purposes. Other uses of sulphur are the making of sulphur dioxide (SO_2); in agriculture (fertilizer and insecticide); in the manufacture of rubber; and in the manufacture of carbon tetrachloride.

The principal sources in the United States are the stratified deposits in Louisiana and Texas, extraction being accomplished by a unique system of wells with steam pipes. It is stated that three large companies operating there are capable of producing more than 2,000,000 tons annually in excess of our normal consumption in the United States, which averages about 1,000,000 tons. The mines at Freeport,

Texas, are in a peculiarly favorable location in that they are practically at tidewater.

Formerly considerable sulphur was imported from Italy and from Japan; but the situation is now reversed, so that in 1929 a total of 855,542 long tons, valued at $17,648,949, was exported from the United States, principally to Europe and Canada, also Australia, New Zealand, Mexico and South America.

Total Production of Sulphur in California.

Sulphur was produced at the famous Sulphur Bank mine in Lake County, during the years 1865–1868 (inc.); following which the property became more valuable for its quicksilver. The Elgin quicksilver mine, near Wilbur Springs, Colusa County, is a similar occurrence.

Production of sulphur in California to date:

Year	*Tons*	*Value*
1865, 1866, 1867 *	941	$53,500
1868 to 1922	----	------
1923, 1924 *	185	4,071
1925 to 1928	----	------
1929	*	*
Totals	1,126	$57,571

* Annual details concealed under 'Unapportioned.'

CHAPTER SIX

SALINES

Bibliography: State Mineralogist Reports III, XIV, XV, XVII–XXVI (inc.). Bulletin 24. Spurr and Wormser, "Marketing of Minerals." "Non-Metallic Minerals," by R. B. Ladoo. See also under each substance.

Under this heading are included borax, common salt, soda, potash, and other alkaline salts. The first two have been produced in a number of localities in California, more or less regularly since the early sixties. Except for a single year's absence, soda has had a continuous production since 1894. Potash, magnesium chloride and sulphate, and calcium chloride have been added to the commercial list in recent years, and in 1926 joined by bromine. The nitrates are still prospective.

Our main resources of salines are the lake beds of the desert regions of Imperial, Inyo, Kern, Los Angeles, San Bernardino, and San Luis Obispo counties, and the waters of the Pacific Ocean.

The total value of this group showed an increase to $10,960,557 in 1929 over the 1928 figures, as detailed in the following tabulation:

Substance	1928		1929		Increase + Decrease— Value
	Tons	Value	Tons	Value	
Borates	109,722	$3,378,552	144,678	$3,312,085	$66,467—
Salt	304,480	1,024,656	392,039	2,665,436	1,640,780 +
Soda	80,838	1,469,297	90,646	1,838,657	369,360 +
Unapportioned*		2,871,552		3,144,379	272,827 +
Total value		$8,744,057		$10,960,557	
Net increase					$2,216,500

* Includes bromine, calcium chloride, magnesium salts and potash.

BORATES

Bibliography: State Mineralogist Reports III, X, XII–XV (inc.), XVII–XXIII (inc.), XXV. Bulletins 24, 67, 91.

During 1929 there was produced in California a total of 162,059 tons of borate materials, compared with 123,761 tons for the year 1928. The material shipped during the year included crude and select colemanite ore from Inyo County, the new sodium borates, kernite (Rasorite), kramerite and some colemanite from Kern County; also crystallized borax prepared by evaporation of brines at Searles Lake in San Bernardino County.

As the crude ore is not sold as such, but is almost entirely calcined before shipping to the refinery for conversion into the borax of commerce, and because of the fact that the material varied widely in boric acid content, we have recalculated the tonnage to a basis of 40 per cent, A. B. A. This is approximately the average A. B. A. content of the colemanite material after calcining, and also of the crystallized borax obtained from evaporation of the lake brines.

Recalculated as above, the 1929 production totals 144,678 tons, valued at $3,312,085, being an increase in quantity but having a decreased value from the similar figures for 1928, which were 109,722 tons and $3,378,552.

Colemanite is a calcium borate, and the material mined is shipped to seaboard chemical plants for refining. The latest development in the borax industry is the finding in quantity and opening up of a new borate mineral which has now supplanted colemanite in much the same way that colemanite deposits displaced the borax industry in the desert playas or dry lakes, some forty years ago. This new mineral is 'kernite' (or 'rasorite'), a sodium borate with a smaller water-of-crystallization content than the 'borax' of commerce, so that when recrystallized to borax, the resulting product has an increased weight over the original material. These deposits are being mined by the Pacific Coast Borax Company in southeastern Kern County.

Refined 'borax' (sodium tetraborate) is used in making the enameled coating for cast-iron and steelware employed in plumbing fixtures, chemical equipment, and kitchen utensils. It is also a constituent of borosilicate glasses which are utilized in making lamp chimneys, baking dishes, and laboratory glassware. Other important uses of borax are in the manufacture of laundry and kitchen soaps, in starch, paper sizing, tanning, welding, and in the preparation of boric acid, which is employed as an antiseptic and in preserving meats. Among the newer uses for borax is its employment in the preserving of citrus fruits by washing them in a solution of borax, which closes the pores of the skin. The application of this process is increasing in California and Florida. Another is as a preservative of wood, in addition to which borax, being noninflammable, renders it fireproof.

During the year shipment of Californian borates were made from a port in this state to twenty-three foreign nations. The total amount exported from the United States[1] in 1929 was 79,884 short tons valued at $2,934,660 compared with 67,851 short tons valued at $3,454,171 in 1928.

Total Production of Borate Materials in California.

Borax was first discovered in California in the waters of Tuscan Springs in Tehama County, January 8, 1856. Borax Lake in Lake County was discovered in September of the same year by Dr. John A. Veach. This deposit was worked in 1864–1868, inclusive, and during that time produced 1,181,365 pounds of refined borax. The bulk of it was exported by sea, to New York. This was the first commercial output of this salt in the United States, and California is still today the leading American producer of borax, having been for many years the sole producer.

Production from the dry lake 'playa' deposits of Inyo and San Bernardino counties began in 1873; but it was not until 1887 that the borax industry was revolutionized by the discovery of the colemanite beds at Calico, in San Bernardino County, and later similar beds in Inyo and Los Angeles counties. The colemanite deposits of Ventura County are at present unworked, owing to lack of transportation facili-

[1] Monthly Summary of Foreign Commerce of the United States, Department of Commerce, Dec., 1929, Part 1.

ties. Some production of colemanite has been made from deposits opened up in Clarke County, Nevada.

The total production of borate materials in California is shown in the following table:

Total Production of Borate Materials in California

Year	Tons	Value	Year	Tons	Value
1864	12	$9,478	1897	8,000	$1,080,000
1865	126	94,099	1898	8,300	1,153,000
1866	201	132,538	1899	20,357	1,139,882
1867	220	156,137	1900	25,837	1,013,251
1868	32	22,384	1901	22,221	982,380
1869			1902	[a]17,202	2,234,994
1870			1903	34,430	661,400
1871			1904	45,647	698,810
1872	140	89,600	1905	46,334	1,019,158
1873	515	255,440	1906	58,173	1,182,410
1874	915	259,427	1907	53,413	1,200,913
1875	1,168	289,080	1908	22,200	1,117,000
1876	1,437	312,537	1909	16,628	1,163,960
1877	993	193,705	1910	16,828	1,177,960
1878	373	66,257	1911	50,945	1,456,672
1879	364	65,443	1912	42,135	1,122,713
1880	609	149,245	1913	58,051	1,491,530
1881	690	189,750	1914	62,500	1,483,500
1882	732	201,300	1915	67,004	1,663,521
1883	900	265,500	1916	103,523	2,409,375
1884	1,019	198,705	1917	109,944	2,561,958
1885	942	155,430	1918	88,772	1,867,908
1886	1,285	173,475	1919	66,791	1,717,192
1887	1,015	116,689	1920	127,065	2,794,206
1888	1,405	196,636	1921	50,136	1,096,326
1889	965	145,473	1922	[b]39,087	1,068,025
1890	3,201	480,152	1923	62,667	1,893,798
1891	4,267	640,000	1924	52,070	1,599,149
1892	5,525	838,787	1925	46,124	1,526,938
1893	3,955	593,292	1926	47,605	1,625,298
1894	5,770	807,807	1927	72,462	3,043,260
1895	5,959	595,900	1928	109,722	3,378,552
1896	6,754	675,400	1929	144,678	3,312,085
			Totals	1,848,340	$61,306 790

[a] Refined borax. [b] Recalculated to 40% 'anhydrous boric acid' equivalent beginning with 1922.

BROMINE

The first commercial production of bromine and bromine compounds was begun during 1926 by the California Chemical Corporation in its plant at Chula Vista, San Diego County, from salt works bittern waters. This same plant has been recovering magnesium chloride for a number of years. A small amount of bromine was also reported made at a similar bittern-water plant at Newark, Alameda County. The total commercial production of bromine in California for 1926 through 1928 amounted to 158 short tons, valued at $120,480, the 1929 production and annual details for the first three years being concealed under the 'Unapportioned' item.

A large part of the bromine output of the United States is not sold as bromine, but in the form of potassium and sodium bromides and other salts. The principal production in the United States has come from bitterns from salt wells in Michigan, Ohio and West Virginia.

The best known uses of bromine are its application in the form of silver bromide in photography and the manufacture of ethyl gasoline. Bromine, as such, was used extensively in the European War in making asphyxiating gases. It also has some uses in medicine, particularly in the treatment of nervous diseases.

CALCIUM CHLORIDE

Bibliography: U. S. Geol. Surv., Min. Res. 1919, Pt. II. Engineering and Contracting, Roads & Streets monthly issue, Feb. 6, 1924. 'How to Maintain Roads,' manual of instruction of Dow Chemical Company.

Calcium chloride is hygroscopic, that is, it has an affinity for water. This property is taken advantage of by utilizing this salt as a drying agent. It is also sprinkled on dirt roads and playgrounds to keep down dust by absorbing moisture. In refrigerating machinery for ice factories, meat-packing houses and cold-storage warehouses, a calcium-chloride solution is stated to have some advantages over salt brine. In fire buckets this solution has an advantage over pure water, in that it has a lower freezing point, does not corrode metal, and tends to keep the buckets full due to its absorbing moisture from the atmosphere. Powdered calcium chloride is used in drying gases, fruits and vegetables.

During 1929 the production of calcium chloride in California came from San Bernardino County from two plants. The annual details are concealed under the 'Unapportioned' item to conceal the output of either operator.

Total Calcium Chloride Production in California.

Commercial production of calcium chloride in California was first reported to the State Mining Bureau in 1921, from two plants in San Bernardino County, being obtained as a by-product in the refining of salt from deposits in certain of the desert dry lakes.

Year	*Tons*	*Value*
1921	683	$22,980
1922 } 1923 } *	1,204	26,580
1924 } 1925 } *	10,988	328,876
1926 } 1927 } *	34,195	508,748
1928 } 1929 } *	12,020	114,080
Totals	59,090	$1,001,264

* Annual details concealed under 'Unapportioned.'

MAGNESIUM SALTS

Bibliography: State Mineralogist Reports XX, XXI. Bulletin 91. 'Dictionary of Applied Chemistry,' by Thorpe. U. S. Geol. Surv., Min. Res. of P. S.

The 1929 production of magnesium salts in California is concealed under 'Unapportioned.' This was the chloride and the carbonate. The chloride was nearly all sold for use in magnesite stucco and cement mixtures (Sorel cement), also some for road liquor. The carbonate, a bulky white powder, was used as a heat-insulating material, as a filler for rubber, paper, paint, etc., and in medicines, in tooth paste, in face powder and as a polish for metal and glass. The sulphate marketed was utilized for medicinal and bath purposes. The material coming from San Diego County was residual bitterns from the salt plants and was in part marketed in the liquid form carrying from

35 per cent to 67 per cent $MgCl_2$ and in part as dry crystals, while that from San Mateo County was magnesium carbonate.

With the use of magnesite cement and stucco coming more into prominence in building construction on the Pacific Coast, the demand for magnesium chloride is increasing here; but the domestic article has to meet the competition of the cheaper, imported German chloride.

The average value reported for the chloride produced in California in 1929 was approximately $18 per ton, f. o. b. plant.

Total Production of Magnesium Salts in California.

Commercial production of magnesium chloride in California was begun in 1916 by some of the salt companies, from the residual bitterns obtained during the evaporation of sea water for its sodium chloride. In addition, some magnesium sulphate, or 'epsom salts' is also made, annually, but in smaller amount, and magnesium carbonate by a patented process, direct from sea water.

The total production of magnesium salts in California, since the beginning of the industry here, is shown in the following tabulation:

Year	*Tons*	*Value*
1916	851	$6,407
1917	1,064	34,973
1918	1,008	29,955
1919	1,616	82,457
1920	3,150	107,787
1921	4,153	106,140
1922	3,036	89,788
1923	3,662	116,031
1924	4,823	145,883
1925	4,221	132,553
1926	4,881	124,470
1927 } 1928 } *	6,241	139,589
1929	*	*
Totals	38,706	$1,116,033

* Annual details concealed under 'Unapportioned.'

NITRATES

Bibliography: State Mineralogist Report XV. Bulletins 24, 67, 91. U. S. G. S., Press Bulletin No. 373, July, 1918. Smithsonian Inst., Publ. No. 2421, 1916.

Nitrates of sodium, potassium and calcium have been found in various places in the desert regions of the state, but no deposit of commercial value has been developed as yet. It is hoped that a closer search may some day be rewarded by workable discoveries. At present the principal commercial source of nitrates is the Chilean saltpeter (sodium nitrate) deposits in South America.

The fixation of atmospheric nitrogen electrically has been accomplished successfully in Germany and Scandinavia. The possibilities of cheap hydro-electric power in California make the subject one of interest to us, as we have also the natural raw materials and chemicals to go with the power. Sodium and potassium cyanides can be made by fixation of atmospheric nitrogen electrically.

POTASH

Bibliography: State Mineralogist Reports XV, XVIII, XX, XXII. Bulletins 24, 67, 91. U. S. G. S., Min. Res. 1913, 1914, 1915. Senate Doc. No. 190, 62 Congress, 2d Session. Mining & Sci. Press, Vol. 112, p. 155; Vol. 114, p. 789. Eng. & Min. Jour.-Press, Vol. 117, p. 557, Apr. 5, 1924.

The 1928 production of potash in California came from a single operator in San Bernardino County, the details of which are concealed under the 'Unapportioned' item. This was principally chloride and the product averaged 60% equivalent K_2O content. The material was sold mainly for fertilizer manufacture.

Imports of crude potash minerals and salts into the United States in 1929, according to the U. S. Bureau of Foreign and Domestic Commerce, amounted to 777,909 long tons valued at $17,638,848, compared with 842,556 long tons and $18,558,213 in 1928. These materials consisted mainly of 'manure salts,' crude chloride (muriate) and sulphate, and kainite, all of which are admitted duty-free.

Quotations have recently ranged from $46 per ton c.i.f. Atlantic and Gulf ports for high-grade sulphate (90%–95%), $35 per ton for muriate (80%–85%), and $19 for manure salts (30%).

Other uses for potash salts, besides those noted above, are in the manufacture of the best liquid soap and some higher-grade cake soaps, of some finer grades of glass, and in matches. The chemical requirements include tanning, dyeing, metallurgy, electroplating, photography and medicine.

Total Production of Potash in California.

Potash production began commercially in California in 1914, with a small yield from kelp. The bulk of the output comes from deposits of potash-bearing residues and brines in the old lake beds of the desert regions, particularly Searles Lake, San Bernardino County. A small amount is made annually from salt-works bitterns, and for a time there was some from Portland cement dust. Some also is obtained from molasses distillery-slops char.

The annual amounts and value of these potash materials, since their beginning in California in 1914, are shown by the following table:

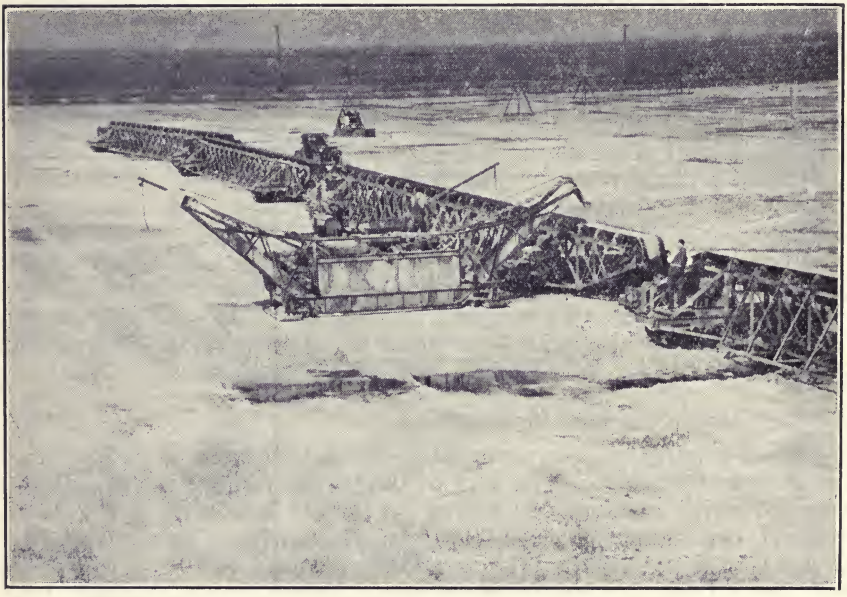
Year	*Tons*	*Value*
1914	10	$460
1915	1,076	19,391
1916	17,908	663,605
1917	129,022	4,202,889
1918	49,381	6,808,976
1919	28,118	2,415,963
1920	26,298	1,465,463
1921	14,806	390,210
1922	17,776	584,388
1923	29,597	709,836
1924	33,107	747,407
1925	36,355	829,770
1926	32,884	812,285
1927	67,340	1,952,852
1928} 1929}*	178,680	5,522,350
Total	662,358	$27,131,845

* Annual details concealed under 'Unapportioned.'

SALT

Bibliography: State Mineralogist Reports II, XII–XV (inc.), XVII–XXIII (inc.), XXV, XXVI. Bulletins 24, 67, 91. U. S. Geol. Survey, Bull. 669. U. S. Bur. of Mines, Bull. 146.

Most of the salt production in California is obtained by evaporation of water of the Pacific Ocean, plants being located on the shores of San Francisco, Monterey, and San Diego bays, and at Long Beach. Additional amounts are derived from lakes and lake beds in the desert regions, mainly in Inyo, Kern and San Bernardino counties, and evaporation of alkaline lake water in Modoc County. A small amount



Salt harvester loading salt on conveyor belt at Alviso, Santa Clara County. Photo by courtesy of Alviso Salt Co.

of valuable medicinal salts is obtained by evaporation of the water of Lake Mono, Mono County.

During 1929 in California there was a production of 392,039 short tons of salt valued at $2,665,436, being an increase over the 1928 figures which were 340,580 tons and $1,024,656. There were sixteen plants operating in 1929, four of which were in Alameda County, two each in San Bernardino and San Mateo counties and one in Inyo, Kern, Los Angeles, Modoc, Mono, Monterey, San Diego and Santa Clara.

The average value reported for salt produced in California in 1929 was $6.80 per ton f. o. b. plant as compared with $3 in 1928.

Production of Salt in California, by Years.

Amount and value of annual production of salt in California from 1887 is shown in the following tabulation:

Year	Tons	Value	Year	Tons	Value
1887	28,000	$112,000	1909	155,680	$414,708
1888	30,800	92,400	1910	174,920	395,417
1889	21,000	63,000	1911	173,332	324,255
1890	8,729	57,085	1912	185,721	383,370
1891	20,094	90,303	1913	204,407	462,681
1892	23,570	104,788	1914	223,806	583,553
1893	50,500	213,000	1915	169,028	368,737
1894	49,131	140,087	1916	186,148	455,695
1895	53,031	150,576	1917	227,825	584,373
1896	64,743	153,244	1918	212,076	806,328
1897	67,851	157,520	1919	233,994	896,963
1898	93,421	170,855	1920	230,638	972,648
1899	82,654	149,588	1921	197,989	832,702
1900	89,338	204,754	1922	223,238	819,187
1901	126,218	366,376	1923	275,979	1,130,670
1902	115,208	205,876	1924	318,800	1,159,137
1903	102,895	211,365	1925	284,068	949,826
1904	95,968	187,300	1926	311,761	1,124,978
1905	77,118	141,925	1927	263,028	639,127
1906	101,650	213,228	1928	340,580	1,024,656
1907	88,063	310,967	1929	392,039	2,665,436
1908	121,764	281,469			
			Totals	6,496,803	$20,772,153

SODA

Bibliography: State Mineralogist Reports XII, XIII, XV, XVII, XVIII, XX, XXII. Bulletins 24, 67, 91. U. S. Geol. Surv., Bull. 717.

The production of sodium salts in California in 1929 included: Soda ash, trona, caustic soda and bicarbonate from plants at Owens Lake, Inyo County, and trona ('sesqui-carbonate,' a double salt of Na_2CO_3 and $NaHCO_3$) from Searles Lake, San Bernardino County. There were no shipments of salt cake (sulphate) from the Carrizo Plains, San Luis Obispo County, in 1929. The total for the year amounted to 90,646 tons, valued at $1,838,657, being an increase in both quantity and value compared with the 1928 figures which were 80,838 tons and $1,469,916.

The dense ash and bicarbonate were used mainly in the manufacture of soap, glass, sugar refining, and chemicals; and the trona for metallurgical purposes.

Sodium compounds to some extent replace potassium compounds, in glass and soap making, in photography, in match making, in tanning, sugar refining, and in the manufacture of cyanide for extracting gold and silver from their ores.

Soda Production of California, by Years.

The total output, showing amount and value of these materials in California since the inception of the statistical records of the State Mining Bureau, is given in the table which follows:

Year	Tons	Value	Year	Tons	Value
1894	1,530	$20,000	1913	1,861	$24,936
1895	1,900	47,500	1914	6,522	115,396
1896	3,000	65,000	1915	5,799	83,485
1897	5,000	110,000	1916	10,593	264,825
1898	7,000	154,000	1917	24,505	928,578
1899	10,000	250,000	1918	20,447	855,423
1900	1,000	50,000	1919	21,294	721,958
1901	8,000	400,000	1920	32,407	1,164,898
1902	7,000	50,000	1921	14,828	438,996
1903	18,000	27,000	1922	20,084	573,661
1904	12,000	18,000	1923	34,885	764,284
1905	15,000	22,500	1924	32,536	711,796
1906	12,000	18,000	1925	48,625	947,649
1907	----------	----------	1926	63,333	1,305,802
1908	9,600	14,400	1927	62,571	1,478,239
1909	7,712	11,593	1928	80,838	1,469,297
1910	8,125	11,862	1929	90,646	1,838,657
1911	9,023	52,887			
1912	7,200	37,094	Totals	814,864	$15,047,716

CHAPTER SEVEN

BY COUNTIES

Introductory.

The State of California includes a total area of 158,297 square miles, of which 155,652 square miles are of land. The maximum width is 235 miles, the minimum 148 miles, and the length from the northwest corner to the southeast corner is 775 miles. The state is divided into fifty-eight counties. The 1930 census figures show a total population for California of 5,672,009. Minerals of commercial value exist in every county, and during 1929 some active production was reported to the State Division of Mines from all of the fifty-eight, with one exception.

Rank of Counties in Mineral Yield, 1929.

Of the first ten counties in point of total value of output for 1929, the first five, Los Angeles, Kern, Ventura, Orange, and Santa Barbara, owe their position mainly to petroleum and natural gas as does Kings (ninth). Los Angeles, due to its crude oil, leads all the others, being credited with 56% of the entire state total value for 1929, having passed Kern in 1923, which led for many years. San Bernardino (sixth) owes it place chiefly to cement, potash, borax, mineral water, stone, and soda. Riverside (seventh) to cement, brick and clay, stone, and gypsum. Plumas (eighth) to copper and San Mateo (tenth) to cement.

There were twenty-five counties, each having a total mineral production in excess of a million dollars in 1929. Cement was an important item in nine; gold in four; miscellaneous stone, copper, and borax in two each; and soda, salt, potash, diatomaceous earth and granite in one each. In point of variety and diversity San Bernardino County led all others in 1929 with a total of 22 different mineral products on its commercial list; followed by Los Angeles and Inyo with 17 each; Riverside and San Diego with 16 each; Kern and Fresno with 15 each; San Luis Obispo with 13; Imperial, Orange, Sacramento, Santa Barbara, Santa Clara, and Ventura with 11 each; and Amador, Butte, Calaveras, Mono, Shasta, and Tuolumne with 10 each. The counties with their mineral resources, production for 1929, etc., are considered in detail in the following paragraphs.

County	*Value*	*County*	*Value*
1. Los Angeles	$243,568,275	16. Inyo	$2,296,210
2. Kern	38,809,239	17. Sacramento	2,249,302
3. Ventura	34,043,899	18. Nevada	1,980,028
4. Orange	28,491,495	19. San Benito	1,908,462
5. Santa Barbara	16,407,136	20. Yuba	1,830,371
6. San Bernardino	11,210,652	21. Contra Costa	1,827,956
7. Riverside	5,401,860	22. Shasta	1,751,196
8. Plumas	5,137,968	23. San Diego	1,447,287
9. Kings	4,259,833	24. Merced	1,110,498
10. San Mateo	3,672,779	25. Madera	1,027,410
11. Alameda	3,626,723	26. Santa Clara	963,478
12. Santa Cruz	3,327,633	27. San Joaquin	789,891
13. Calaveras	2,522,259	28. Napa	649,822
14. Amador	2,498,217	29. Butte	584,319
15. Fresno	2,413,495	30. Trinity	525,874

County	Value	County	Value
31. Imperial	$509,832	46. San Luis Obispo	$191,084
32. Marin	470,002	47. Lassen	88,698
33. Sierra	390,402	48. Del Norte	84,263
34. Stanislaus	388,235	49. Glenn	81,516
35. Lake	387,700	50. San Francisco	75,245
36. Tuolumne	371,520	51. Solano	66,421
37. El Dorado	367,500	52. Mendocino	59,000
38. Monterey	354,858	53. Colusa	42,570
39. Sonoma	351,383	54. Alpine	33,013
40. Tulare	296,881	55. Modoc	30,996
41. Humboldt	293,678	56. Tehama	14,480
42. Placer	266,347	57. Yolo	14,400
43. Mariposa	244,017	58. Sutter	----------
44. Siskiyou	229,789		
45. Mono	212,831	Total	$432,248,228

ALAMEDA

Land area: 732 square miles.
Population: 475,153 (1930 census).
Location: East side of San Francisco Bay.
County seat: Oakland.
References: State Mineralogist Report XVII: XVIII: XX: XXVI (Oct. 1929).

Alameda County, while in no sense one of the 'mining counties,' comes eleventh on the list, with a value of mineral production for 1929 of $3,626,723 and having nine different substances. This was an increase over the 1928 output, which was $2,421,830.

The mineral resources of this county include asbestos, brick, chromite, clay, coal, copper, gold, limestone, quartz crystals, glass-sand, sandstone, silver, soapstone, and miscellaneous stone.

Commercial production for 1929 was as follows:

Substance	Amount	Value
Brick and hollow building tile	----------	$304,326
Clay (pottery)	7,037 tons	6,980
Copper	[a] 321,844 lbs.	48,016
Salt	264,666 tons	1,623,397
Silver	104 fine oz.	55
Stone, miscellaneous	--------	1,592,232
Other minerals *	--------	51,717
Total value		$3,626,723

[a] Covering a period of 4 years.
* Includes mineral paint and pyrite.

ALPINE

Land area: 776 square miles.
Population: 236 (1930 census).
Location: On eastern border of state, south of Lake Tahoe.
County seat: Markleeville.
References: State Mineralogist Report XV: XVII: XVIII.

This county lies just south of Lake Tahoe, in the high Sierra Nevada. Transportation is by auto, wagon, or mule back, and facilities in general are lacking to promote development work.

The mineral resources of this section are varied and the country has not yet been thoroughly prospected. Occurrences of barium, copper, gold, gypsum, lead, limestone, pyrite, rose quartz, silver, tourmaline, and zinc have been noted here.

Commercial production for 1929 was $33,013, being an increase over the 1928 amount, which was $8,529.

Substance	*Amount*	*Value*
Copper	7,260 lbs.	$1,278
Stone, miscellaneous	----	31,735
Total value		$33,013

AMADOR

Land area: 601 square miles.
Population: 8494 (1930 census).
Location: East-central part of state—Mother Lode District.
County seat: Jackson.
References: State Mineralogist Report XIV: XVII: XVIII: XIX: XX: XXIII (April, 1927).

The value of Amador County's mineral production decreased from $2,644,179 in 1928 to $2,498,216 in 1929, placing it number nineteenth on the list of counties in the state as regards total value of mineral substances marketed. The decrease was due mainly to gold.

Although having an output consisting of ten different minerals, the leading product, gold, makes up approximately 65% of the total value for the year.

Amador at one time led the state in gold production, though exceeded in 1920–1923 and in 1926–1927 by Yuba and Nevada counties, but in 1925 and 1928 by Yuba only, and in 1929 by Nevada only.

Commercial output for 1929 was as follows:

Substance	*Amount*	*Value*
Clay (pottery)	60,487 tons	$88,846
Gold	-----	1,601,861
Silver	17,621 fine oz.	9,392
Stone, miscellaneous	-----	696,500
Other minerals*	-----	101,618
Total value		$2,498,217

*Includes brick, coal, copper, lead, marble.

BUTTE

Land area: 1722 square miles.
Population: 34,010 (1930 census).
Location: North-central portion of state.
County seat: Oroville.
References: State Mineralogist Report XV: XVII: XVIII: XXIV (July, 1928).

Butte, twenty-ninth county in California in regard to value of its mineral output, reports a commercial production of ten mineral substances having a total value of $584,319 as compared with $640,308 for 1928. Gold was the most important, and its production had the greatest annual value in this county until 1928, when the value of the output of miscellaneous stone passed that of gold.

Butte stands fourteenth among the gold-producing counties of the state. Among the mineral resources of this section are asbestos, barytes, chromite, gems, gold, limestone, marble, mineral water, platinum group, silver and miscellaneous stone.

Commercial value for 1929 was as follows:

Substance	*Amount*	*Value*
Gems (diamonds and precious serpentine)	---	$550
Gold	---	71,917
Limestone	924 tons	4,108
Silver	329 fine oz.	175
Stone, miscellaneous	---	485,187
Other minerals*	---	22,382
Total value		$584,319

*Includes brick, mineral water, natural gas, soapstone.

CALAVERAS

Land area: 1027 square miles.
Population: 6,009 (1930 census).
Location: East-central portion of state—Mother Lode District.
County seat: San Andreas.
References: State Mineralogist Report XIV: XVII: XVIII: XIX: XX: XXI (April, 1925).

Calaveras County reported production of ten different minerals, valued at $2,523,259 during the year 1929, as compared with $2,802,542 for 1928. Cement, stone, gold, and copper are the chief mineral substances. Calaveras County stands thirteenth among the counties in regard to the total value of mineral output for 1929, and tenth in gold.

The principal mineral resources developed and undeveloped are: Asbestos, chromite, clay, copper, fuller's earth, gold, limestone, marble, mineral paint, mineral water, platinum group, pyrite, quartz crystals, silver, soapstone, and miscellaneous stone.

Commercial output for 1929 was as follows:

Substance	*Amount*	*Value*
Copper	1,200,494 lbs.	$211,287
Gold	---	103,843
Lead	8,277 lbs.	521
Silver	6,461 fine oz.	3,444
Stone, miscellaneous	---	306,982
Other minerals*	---	1,896,182
Total value		2,522,259

*Includes cement, clay, gems (quartz crystals), mineral water.

COLUSA

Land area: 1140 square miles.
Population: 10,257 (1930 census).
Location: Sacramento Valley.
County seat: Colusa.
References: State Mineralogist Report XIV: XVII: XVIII: XXV (April, 1929).

Colusa County lies largely in the basin of the Sacramento Valley. Its western border, however, rises into the foothills of the Coast Range of mountains, and its mineral resources—largely undeveloped—include coal, chromite, copper, gypsum, manganese, mineral water, pyrite, quicksilver, sandstone, miscellaneous stone, sulphur, and in some places traces of gold and silver.

The value of the 1929 mineral production was $42,570, being an increase from the 1928 figure, which was $36,500, giving it fifty-third place in the order of mineral value, and was as follows:

Substance	*Value*
Stone, miscellaneous	$35,000
Other minerals*	7,570
Total value	$42,570

*Includes petroleum, quicksilver, sulphur.

CONTRA COSTA

Land area: 714 square miles.
Population: 78,554 (1930 census).
Location: East side of San Francisco Bay.
County seat: Martinez.
References: State Mineralogist Report XVII : XVIII : XXIII (Jan., 1927).

Contra Costa, like Alameda County, lies on the eastern shore of San Francisco Bay, and is not commonly considered among the mineral-producing counties of the state. It stands twenty-first on the list in this respect, with an output valued at $1,827,956 for 1929 as compared with $2,100,482 in 1928.

Various structural materials make up the chief items, including brick, cement, limestone, and miscellaneous stone. Among the others are asbestos, clay, coal, gypsum, manganese, mineral water, and soapstone.

Commercial production for 1929 was as follows:

Substance	*Amount*	*Value*
Clay (pottery)	7,003 tons	$6,327
Stone, miscellaneous	----	413,837
Other minerals*	----	1,407,792
Total value		$1,827,956

*Includes brick and hollow building tile, cement, mineral water, silica (glass sand).

DEL NORTE

Land area: 1024 square miles.
Population: 4734 (1930 census).
Location: Extreme northwest corner of state.
Transportation: Motor, wagon and mule back; steamer from Crescent City.
County seat: Crescent City.
References: State Mineralogist Report XIV: XVII: XXI (July, 1925).

Del Norte almost rivals Alpine County in regard to inaccessibility. Like the latter county, also, given transportation and kindred facilities, this portion of the state presents a field for development along mining lines especially. Its chief mineral resources, largely untouched, are chromite, copper, gems, gold, iron, platinum group, silver, and miscellaneous stone.

The 1929 output was a decrease from the figure of $381,358 in 1928, the principal item of which is crushed rock used on highway construction, and rock used on the Crescent City harbor jetty.

Commercial production for 1929, giving it forty-eighth place, was as follows:

Substance	*Amount*	*Value*
Copper	5,002 lbs.	$880
Silver	6 fine oz.	3
Stone, miscellaneous	----	83,380
Total value		$84,263

EL DORADO

Land area: 1753 square miles.
Population: 8303 (1930 census).
Location: East-central portion of the state, northernmost of the Mother Lode counties.
County seat: Placerville.
References: State Mineralogist Report XV: XVII: XVIII: XIX: XX: XXII (Oct., 1926).

El Dorado County, which contains the locality where gold in California was first heralded to the world, comes thirty-seventh on the list of counties ranked according to the value of their total mineral production during the year 1929. In addition to the segregated figures here given, a large tonnage of limestone is annually shipped from El Dorado for use in cement manufacture, and whose value is included in the state total for cement. The 1929 mineral production of $367,500 was an increase from $329,427 in 1928.

The mineral resources of this section, many of them undeveloped, include asbestos, barytes, chromite, clay, copper, gems, gold, iron, molybdenum, limestone, quartz crystals, quicksilver, slate, soapstone, silver, and miscellaneous stone.

Commercial production for 1929 was as follows:

Substance	*Amount*		*Value*
Gold	-----		$57,680
Limestone	71,033	tons	199,989
Silver	443	fine oz.	236
Stone, miscellaneous	-----		25,665
Other minerals*	-----		83,930
Total value			$367,500

* Includes copper, lime, silica, slate, soapstone.

FRESNO

Land area: 5950 square miles.
Population: 144,369 (1930 census).
Location: South-central portion of state.
County seat: Fresno.
References: State Mineralogist Report XIV: XVII: XVIII: XXV (July, 1929).

Fresno County, fifteenth in importance as a mineral producer among the counties of California, reports an output for 1929 of fifteen different mineral substances, with a total value of $2,413,495, a decrease from the 1928 production, which was worth $4,227,286.

Commercial production for 1929 was as follows:

Substance	*Amount*		*Value*
Gold	--------		$13,575
Granite	--------		28,000
Quicksilver	10	flasks	1,190
Silver	148	fine oz.	79
Natural gas	1,006,110	M cu. ft.	190,598
Petroleum	3,498,107	bbls.	1,781,586
Stone, miscellaneous	--------		301,542
Other minerals *	--------		13,600
Total value			$2,413,495

* Includes brick and hollow building tile, copper, diatomaceous earth, gems, mineral water, pumice.

GLENN

Land area: 1259 square miles.
Population: 10,935 (1930 census).
Location: West side of Sacramento Valley.
County seat: Willows.
References: State Mineralogist Report XIV: XVII: XVIII.

Glenn County, standing forty-ninth, owes its position among the mineral-producing counties of the state mainly to the presence of large deposits of sand and gravel which are annually worked, the product being used for railroad ballast, etc. In 1917 and 1918, chromite was also an important item. In the foothills in the western portion of the county, deposits of chromite, copper, manganese, sandstone, and soapstone have been found.

Commercial production for 1929 was as follows, being a decrease from $101,889 of the previous year:

Substance	*Value*
Stone, miscellaneous	$81,516

HUMBOLDT

Land area: 3634 square miles.
Population: 43,189 (1930 census).
Location: Northwestern portion of state, bordering on Pacific Ocean.
County seat: Eureka.
References: State Mineralogist Report XIV: XVII: XVIII: XXI (July, 1925.)

Humboldt County is almost entirely mountainous, transportation within its limits being very largely by auto and wagon road, and trail, and until 1915, when railroad communication was established with the outside world, the only method of outside communication was by steamer. The county is rich in mineral resources, among which are brick, chromite, coal, clay, copper, gold, iron, mineral water, natural gas, petroleum, platinum, silver, and miscellaneous stone.

Humboldt ranks forty-first in the value of its mineral output among the counties of the state for 1929 with eight different mineral substances, valued at $293,678 as compared with 1928 output valued at $300,227.

Commercial production for 1929 was as follows:

Substance	*Amount*	*Value*
Copper	64,553 lbs.	$11,361
Gold	-----	2,372
Silver	189 fine oz.	101
Stone, miscellaneous	-----	270,422
Other minerals*	-----	9,422
Total value		$293,678

*Includes brick, clay, natural gas.

IMPERIAL

Land area: 4089 square miles.
Population: 60,894 (1930 census).
Location: Extreme southeast corner of the state.
County seat: El Centro.
References: State Mineralogist Report XIV: XVII: XVIII: XIX: XX: XXII (April, 1926).

During 1929 Imperial County produced ten mineral substances having a total value of $509,832, an increase from the 1928 output, which was $241,678. It ranks thirty-first in total value of mineral production for the year. This county contains deposits of cyanite, gold, gypsum, lead, manganese, marble, pumice, salt, silver, sodium, and strontium, largely undeveloped.

Commercial production for 1929 was as follows:

Substance	*Amount*	*Value*
Gold	--	$1,030
Silver	30 fine oz.	16
Stone, miscellaneous	--	230,199
Other minerals *	--	278,587
Total value		$509,832

* Includes clay (bentonite), copper, cyanite, feldspar, mica (sericite), pumice, silica.

INYO

Land area: 10,019 square miles.
Population: 6557 (1930 census).
Location: Lies on eastern border of state, north of San Bernardino County.
County seat: Independence.
References: State Mineralogist Report XV: XVII: XVIII: XX: XXII (Oct., 1926).

Inyo, the second largest county in the state, and containing less than one inhabitant per square mile, is extremely interesting from a mineralogical point of view. It is noted because of the fact that within its borders are located both the highest point, Mount Whitney (elevation 14,502 feet), and the lowest point, Death Valley (elevation 290 feet below sea level), in the United States. In the higher mountainous sections are found many vein-forming minerals, and in the lake beds of Death Valley saline deposits exist.

Inyo mineral production during the year 1929 reached a value of $2,296,210, standing sixteenth among the counties of the state in this respect. Seventeen different mineral substances were produced. The 1928 output was valued at $1,832,567. Its mineral resources include antimony, asbestos, barytes, borates, copper, dolomite, gems, gold, gypsum, lead, marble, soda, sulphur, talc, tungsten and zinc.

Commercial production for 1929 was as follows:

Substance	*Amount*	*Value*
Copper	17,733 lbs.	$3,121
Gold	--	16,889
Lead	1,335,831 lbs.	84,157
Silver	43,544 fine oz.	23,209
Soda	70,440 tons	1,525,060
Stone, miscellaneous	--	224,625
Talc	8,274 tons	120,875
Other minerals *	--	298,274
Total value		$2,296,210

* Includes borates, dolomite, fuller's earth, gems, granite (tuff), limestone, marble, pumice, salt, tungsten.

KERN

Land area: 8003 square miles.
Population: 82,219 (1930 census).
Location: South-central portion of state.
County seat: Bakersfield.
References: State Mineralogist Report XIV: XVII: XVIII: XXIX: XX: XXV (Jan., 1929).

Kern County, because of its immensely productive oil fields, for many years stood preeminent among all counties of California in the value of its mineral output, the exact figures for 1929 being $38,809,239. Kern was surpassed by both Los Angeles and Orange counties in 1923, but by Los Angeles only in 1924–1929, for which petroleum also is responsible. The 1928 mineral output for this county was worth $43,-064,781. The decrease was due to a smaller quantity and lower prices of crude oil. During 1929 fifteen different mineral substances were produced.

Among the mineral resources, developed and undeveloped, of this section are antimony, asphalt, borax, brick, clay, cement, copper, feldspar, fuller's earth, gems, gold, gypsum, iron, lead, limestone, magnesite, marble, mineral paint, natural gas, petroleum, potash pumice salt, silica, silver, soapstone, soda, sulphur, and tungsten.

Commercial production for 1929 was as follows:

Substance	*Amount*	*Value*
Brick	3,503 M	$44,681
Clay (pottery)	58,551 tons	85,845
Gold	----------	148,421
Natural gas	34,409,095 M cu. ft.	1,861,950
Petroleum	43,577,420 bbls.	32,299,584
Silver	4,337 fine oz.	2,312
Stone, miscellaneous	----------	361,896
Other minerals*	----------	4,004,550
Total value		$38,809,239

*Includes borates, cement, fuller's earth, volcanic ash, quicksilver, salt, tungsten.

KINGS

Land area: 1559 square miles.
Population: 25,277 (1930 census).
Location: South-central portion of the state.
County seat: Hanford.
References: State Mineralogist Report XIV: XVII: XVIII. XXVI: (Oct., 1930.)

Little development has taken place in Kings County along mineral lines to date. Deposits of fuller's earth, gypsum, mineral paint, natural gas, and quicksilver, of undetermined extent, have been found in the county. Drilling for oil has been under way, and commercial output recorded for the first time in 1926.

Tulare Lake is in Kings County, though now largely drained, and the land under cultivation.

Kings County is ninth in value of mineral production for 1929, accounted for by the bringing in of oil wells at Kettleman Hills in 1928.

Commercial output for 1929 was as follows:

Substance	*Amount*	*Value*
Natural gas	25,809,765 M cu. ft.	$965,165
Petroleum	1,968,729 bbls.	3,294,668
Total value		$4,259,833

LAKE

Land area: 1278 square miles.
Population: 7166 (1930 census).
Location: About fifty miles north of San Francisco Bay and the same distance inland from the Pacific Ocean.
County seat: Lakeport.
References: State Mineralogist Report XIV: XVII: XVIII: XX: XXV (July, 1929).

On account of its topography and natural beauties, Lake County is sometimes referred to as the Switzerland of America. The mineral resources which exist here are many and varied, actual production being comparatively small, as shown by the table below, and in the past composed mainly of quicksilver and mineral water. Some of the leading minerals found in this section, in part as yet undeveloped, are asbestos, borax, chromite, clay, copper, gems, gold, gypsum, mineral water, quicksilver, silver, and sulphur.

Lake County was in thirty-fifth place as to value of mineral output. Commercial production for 1929 was as follows:

Substance	*Amount*	*Value*
Mineral water	30,956	$22,100
Quicksilver	1,697 flasks	203,247
Stone, miscellaneous	----	154,200
Other minerals*	----	8,153
Total value		$387,700

*Includes gems and natural gas.

LASSEN

Land area: 4531 square miles.
Population: 12,587 (1930 census).
Location: Northeast portion of state.
County seat: Susanville.
References: State Mineralogist Report XV: XVII: XVIII: XIX: XXV (Jan., 1929).

Lassen County is one of the only partly-developed sections of California. Since about 1912 a railroad traversing the county north and south has been in operation, thus affording opportunity for development along mineral and other lines.

Among the mineral resources of this county are copper, gems, gypsum, gold, silver, and sulphur. In the past, some gold had been produced, but not for some years, until 1921, when the yield again became important. In forty-seventh place, commercial production for 1929 was as follows:

Substance	*Amount*	*Value*
Gold	--	$168
Silver	4 fine oz.	2
Stone, miscellaneous	--	88,328
Unapportioned	--	200
Total value		$88,698

LOS ANGELES

Land area: 4067 square miles.
Population: 2,201,526 (1930 census).
Location: One of the southwestern coast counties.
County seat: Los Angeles.
References: State Mineralogist Report XV: XVII: XVIII: XIX: XX: XXIII (July, 1927).

Mineral production in Los Angeles County for the year 1929 amounted in value to $243,568,275, as compared to the 1928 output worth $144,835,988. This accounted for 56% of the entire state's total for 1929, and ranks Los Angeles first in the state as a mineral producer, having in 1923 passed Kern County, which had been leading for several years. The increase in 1929 was due to an increased production of petroleum.

Its output of brick and tile was over two million dollars, that of miscellaneous stone over five million dollars, natural gas over seventeen million dollars and that of petroleum two hundred million dollars.

Among the mineral resources may be noted asphalt, barytes, borax, brick, clay, fuller's earth, gems, gold, gypsum, infusorial earth, limestone, marble, mineral paint, mineral water, natural gas, petroleum, salt, glass-sand, sandstone, serpentine, silver, soapstone, and miscellaneous stone. Some potash has been obtained from kelp.

Commercial production for 1929, consisting of seventeen substances, was as follows:

Substance	*Amount*		*Value*
Brick	199,260	M	$2,473,675
Building tile (hollow)	18,698	tons	281,695
Clay (pottery)	88,066	tons	49,304
Copper	1,981	lbs.	349
Gold			991
Mineral water	12,525,565	gal.	1,076,504
Natural gas	228,708,726	M cu. ft.	17,410,493
Petroleum	182,444,261	bbls.	216,871,493
Sandstone (flagstone)			20,940
Silver	64	fine oz.	34
Stone, miscellaneous			5,335,300
Other minerals *			47,497
Total value			$243,568,275

* Includes granite, limestone, marble, salt, soapstone.

MADERA

Land area: 2112 square miles.
Population: 17,152 (1930 census).
Location: East-central portion of state.
County seat: Madera.
References: State Mineralogist Report XIV: XVII: XVIII: XXIV (Oct., 1928).

Madera County produced six different mineral substances during the year 1929, having a total value of $1,027,410, as compared with the 1928 output worth $514,490, the increase being due to granite. This county contains deposits of copper, gold, granite, iron, lead, molybdenum, pumice, silver, and miscellaneous stone.

In twenty-fifth place, commercial production for 1929 was as follows:

Substance	*Amount*	*Value*
Copper	19,254 lbs.	$3,389
Gold	-----	1,474
Silver	891 fine oz.	475
Other minerals*	-----	1,022,072
Total value		$1,027,410

*Includes miscellaneous stone and granite.

MARIN

Land area: 529 square miles.
Population: 41,635 (1930 census).
Location: Adjoins San Francisco on the north.
County seat: San Rafael.
References: State Mineralogist Report XIV: XVII: XVIII: XXII (July, 1926).

Mineral production in Marin County during 1929 amounted to $470,002, compared with $449,568 in 1928.

This county is not especially prolific in minerals, although among its resources along these lines are brick, gems, manganese, mineral water, soapstone, and miscellaneous stone.

In thirty-second place, commercial production for 1929 was as follows:

Substance	*Value*
Unapportioned*	$470,002

*Includes brick, mineral water, miscellaneous stone.

MARIPOSA

Land area: 1453 square miles.
Population: 2530 (1930 census).
Location: Most southerly of the Mother Lode counties. East-central portion of state.
County seat: Mariposa.
References: State Mineralogist Report XIV: XVII: XVIII: XIV (April, 1928).

Mariposa County is one of the distinctly 'mining' counties of the state, although it stands but forty-third on the list of counties in regard to the value of its mineral output for 1929, with a total of $244,017, as compared with $282,201 in 1928.

Its mineral resources are varied, among the more important items being barytes, copper, gems, gold, lead, marble, silver, slate, soapstone, and miscellaneous stone.

The Yosemite Valley is in Mariposa County.

Commercial production for 1929 was as follows:

Substance	*Amount*	*Value*
Copper	6,302 lbs.	$1,109
Gold	----	91,052
Silver	1,221 fine oz.	651
Stone, miscellaneous	----	64,966
Other minerals *	----	86,239
Total value		$244,017

* Includes barytes and silica.

MENDOCINO

Land area: 3453 square miles.
Population: 23,491 (1930 census).
Location: Joins Humboldt County on the south and bounded by the Pacific Ocean on the west.
County seat: Ukiah.
References: State Mineralogist Report XIV: XVII: XVIII: XIX: XX.

Mendocino County's annual mineral production has usually been small, the 1929 output being valued at $59,000, ranking fifty-second among the counties, as compared with $40,490 in 1928.

Deposits of in part undetermined value of asbestos, chromite, coal, copper, graphite, magnesite, and mineral water have been found, as well as traces of gold, platinum, and silver.

Commercial production for 1929 was as follows:

Substance	*Value*
Stone, miscellaneous	$55,925
Other minerals*	3,075
Total value	$59,000

* Includes brick and natural gas.

MERCED

Land area: 1995 square miles.
Population: 36,900 (1930 census).
Location: About the geographical center of the state.
County seat: Merced.
References: State Mineralogist Report XIV: XVII: XVIII: XXI (April, 1925).

Merced County as a whole lies in the San Joaquin Valley and it figures as one of the lesser mineral producing counties of the state. The 1929 mineral output was valued at $1,110,498, compared with $653,187 in 1928, the increase being due to cement.

Gold, platinum, and silver were formerly obtained in important amounts by dredging, which ceased in this county in 1918, though a small yield from other sources is still occasionally had. Undeveloped deposits of antimony, magnesite, quicksilver, and limestone have been noted in this county in addition to the foregoing.

In twenty-fourth place, commercial production during 1929 was as follows:

Substance	*Amount*	*Value*
Gold	---	$84,188
Silver	349 fine oz.	186
Other minerals*	---	1,026,124
Total value		$1,110,498

* Includes brick and hollow building tile, cement, miscellaneous stone.

MODOC

Land area: 3823 square miles.
Population: 8038 (1930 census).
Location: The extreme northeast corner of the state.
County seat: Alturas.
References: State Mineralogist Report XV: XVII: XVIII: XXV (Jan., 1929.)

Modoc County, like Lassen, has only in recent years had the benefit of communication with the outside world by rail. Among its known mineral resources are clay, coal, gold, iron, quicksilver, salt, and silver.

In fifty-fifth place, commercial production for 1929 was as follows:

Substance	*Value*
Stone, miscellaneous	$30,346
Unapportioned	650
Total value	$30,996

MONO

Land area: 3030 square miles.
Population: 1359 (1930 census).
Location: Is bordered by the state of Nevada on the east and is about in the central portion of the state measured on a north and south line.
County seat: Bridgeport.
References: State Mineralogist Report XV: XVII: XVIII: XX: XXIII (Oct., 1927).

Gold mining has been carried on in portions of Mono County for many years, although, taken as a whole, it lies in a somewhat inaccessible country so far as rail transportation is concerned. It is in the continuation of the heavily mineralized belt which was noted in Inyo County and contains among other mineral resources andalusite, barytes, clay, copper, gold, limestone, molybdenum, pumice, salt, silver, and travertine.

In forty-fifth place with ten different substances, commercial production for 1929 was as follows:

Substance	*Amount*	*Value*
Copper	16,552 lbs.	$2,913
Gold	-----	10,025
Lead	19,602 lbs.	1,235
Silver	52,791 fine oz.	28,138
Stone, miscellaneous	-----	15,257
Other minerals*	-----	161,263
Total value		$218,831

*Includes andalusite, clay (pottery), pumice, volcanic ash, salt.

MONTEREY

Land area: 3330 square miles.
Population: 53,668 (1930 census).
Location: West-central portion of state, bordering on Pacific Ocean.
County seat: Salinas.
References: State Mineralogist Report XV: XVII: XVIII: XIX: XXI (Jan., 1925).

Monterey County produced nine different mineral substances during 1929, having a total value of $354,858, as compared with the 1928

output worth $351,660. Its mineral resources include brick, clay, copper, coal, diatomaceous earth, dolomite, feldspar, fuller's earth, gold, gypsum, limestone, mineral water, petroleum, quicksilver, glass-sand, sandstone, silver, and miscellaneous stone.

In thirty-eighth place, commercial production for 1929 was as follows:

Substance	*Amount*	*Value*
Gold	---	$263
Sandstone	---	11,900
Silver	2 fine oz.	1
Stone, miscellaneous	---	213,082
Other minerals*	---	129,612
Total value		$354,858

* Includes clay (pottery), diatomaceous earth, dolomite, salt, silica (glass sand).

NAPA

Land area: 783 square miles.
Population: 22,832 (1930 census).
Location: Directly north of San Francisco Bay—one of the 'bay counties.'
County seat: Napa:
References: State Mineralogist Report XIV: XVII: XVIII: XX: XXV (April, 1929).

Napa, because of its production of structural and industrial materials and mineral water, stands twenty-eighth on the list of mineral-producing counties in California. Its mineral resources include chromite, copper, magnesite, mineral water, quicksilver, sandstone, and miscellaneous stone. In the past this county has been one of the important producers of quicksilver.

In 1929 the value of the output was $649,822, as compared with the 1928 output, worth $306,262.

Commercial production for 1929 was as follows:

Substance	*Amount*	*Value*
Copper	4,356 lbs.	$767
Gold	----	17,781
Mineral water	86,141 gal.	90,703
Quicksilver	2,081 flasks	246,747
Silver	144,180 fine oz.	76,848
Stone, miscellaneous	------	216,420
Other minerals*	------	556
Total value		$649,822

* Includes lead and standstone.

NEVADA

Land area: 974 square miles.
Population: 10,589 (1930 census).
Location: North of Lake Tahoe, on the eastern border of the state.
County seat: Nevada City.
References: State Mineralogist Report XVI: XVII: XVIII: XIX: XX: XXVI (April, 1930).

Nevada, one of the mountain counties of California, for some years alternated with Amador in the gold lead, but both were passed by Yuba in 1918–1921, also 1923. In 1922, 1924, and 1929, Nevada led all counties in gold output, but it held third place in 1925 and 1928, and

second place in 1926 and 1927. Nevada County stands eighteenth on the list of counties in regard to value of its total mineral output for 1929, with a production worth $1,980,028, as compared with the 1928 production worth $2,023,886, the decrease being due to gold and miscellaneous stone.

While this county actually produces mainly gold and silver, its resources cover a wide scope, including antimony, asbestos, barytes, chromite, clay, copper, gems, iron, lead, mineral paint, pyrites, soapstone, and tungsten.

Commercial production for 1929 was as follows:

Substance	*Amount*	*Value*
Copper	5,702 lbs.	$1,004
Gold	-----	1,807,613
Lead	6,603 lbs.	416
Silver	41,015 fine oz.	21,861
Stone, miscellaneous	-----	83,770
Other minerals*	-----	65,364
Total value		$1,980,028

*Includes barytes and granite.

ORANGE

Land area: 795 square miles.
Population: 118,611 (1930 census).
Location: Southwestern portion of state, bordering Pacific Ocean.
County seat: Santa Ana.
References: State Mineralogist Report XV: XVII: XVIII: XIX: XX: XXI (Jan., 1925).

Orange County is one of the many in California which on casual inspection appears to be anything but a mineral-producing section. It stood for many years, however, as the second county in the state in regard to the total value of mineral output, on account of its highly productive oil fields. It was passed in 1922 by Los Angeles, the credit for which is also due to oil, and in turn Orange passed Kern County in 1923, but dropped back to third in 1924–1928, and dropped to fourth place in 1929, being passed by Ventura County.

This county showed a mineral production for 1929 of $28,461,495 compared with the 1928 output worth $39,655,177, the decrease being due to decreased petroleum output.

Orange passed Shasta County in 1917, which previously for a number of years had exceeded all other counties in California, except Kern.

Aside from the substances actually produced and noted in the table below, coal, gypsum, iron, infusorial earth, sandstone, and tourmaline have been found in Orange County.

Commercial production for 1929 was as follows:

Substance	*Amount*	*Value*
Brick	774 M	$7,743
Clay (pottery)	30,147 tons	111,349
Gold	-----	29
Lead	1,471 lbs.	93
Natural gas	31,318,309 M cu. ft.	2,602,382
Petroleum	25,861,815 bbls.	25,504,622
Silver	339 fine oz.	447
Stone, miscellaneous	-----	263,250
Other minerals*	-----	1,280
Total value		$28,461,495

*Includes copper and quicksilver.

PLACER

Land area: 1395 square miles.
Population: 24,442 (1930 census).
Location: Eastern border of state directly west of Lake Tahoe.
County seat: Auburn.
References: State Mineralogist Report XV: XVII: XVIII: XIX: XX: XXIII (July, 1927).

While standing only forty-second on the list of mineral-producing counties, Placer contains a wide variety of mineral substances, some of which have not been commercially exploited. Its leading products include gold, chromite, granite, copper, and clay. Other mineral resources are asbestos, brick, coal, gems, iron, lead, limestone, magnesite, manganese, marble, quartz crystals, glass sand, silver and miscellaneous stone.

Commercial production for 1929 was as follows compared to a total value of $333,135 for the previous year:

Substance	*Amount*	*Value*
Clay (pottery)	118,704 tons	$158,531
Gold	------	34,691
Granite	------	20,385
Silver	250 fine oz.	133
Stone, miscellaneous	------	9,469
Other minerals*	------	43,136
Total value		$266,347

* Includes brick, hollow building tile, mineral paint, silica.

PLUMAS

Land area: 2594 square miles.
Population: 7909 (1930 census).
Location: Northeastern border of state, south of Lassen County.
County seat: Quincy.
References: State Mineralogist Report XVI: XVII: XVIII: XIX: XX: XXIV (Oct., 1928).

A considerable portion of the area of Plumas County lies in the high mountains, and deposits of the metals, especially gold and copper, are found there. Mineral production for 1929 was valued at $5,137,968 compared with $3,599,127 in 1928. The large increase was due to copper, but all mineral substances showed an increase in this county. This placed the county eighth in rank. In 1919 Plumas passed Shasta in the copper lead, owing to the Shasta smelters being closed down, which position Plumas still retains.

Among its mineral resources are chromite, copper, gold, granite, iron, lead, limestone, manganese, molybdenum, platinum, silver, and zinc.

Commercial production for 1929 was as follows:

Substance	*Amount*	*Value*
Copper	25,253,603 lbs.	$4,444,634
Gold	---------	391,682
Silver	408,466 fine oz.	271,712
Stone, miscellaneous	---------	80,420
Other minerals*	---------	3,520
Total value		$5,137,968

* Includes granite, lead, manganese.

RIVERSIDE

Land area: 7240 square miles.
Population: 82,078 (1930 census).
Location: Southern portion of state.
County seat: Riverside.
References: State Mineralogist Report XV: XVII: XVIII: XX: XXV (Oct., 1929).

Riverside is the fourth county in the state in size and the seventh in regard to the total value of mineral output for 1929. Within its borders are included mountain, desert, and agricultural land. Its mineral resources include metals, structural and industrial materials, and salines, some of the more important being brick, clay, coal, copper, feldspar, gold, gypsum, iron, lead, limestone, manganese, magnesite, marble, mineral paint, mineral water, salt, soapstone, silver, miscellaneous stone, and tin. In point of variety, Riverside County showed fifteen different minerals commercially produced in 1929. The decrease in 1929 from the 1928 output, valued at $6,274,901, was due to brick and miscellaneous stone.

Commercial production for 1929 was as follows:

Substance	*Amount*	*Value*
Brick and hollow building tile	------	$544,850
Clay (pottery)	184,179 tons	319,130
Copper	1,471 lbs.	259
Gold	------	244
Silica (quartz and glass sand)	28,140 tons	41,647
Silver	1,468 fine oz.	782
Stone, miscellaneous	------	454,589
Other minerals*	------	4,040,359
Total value		$5,401,860

*Includes cement, feldspar, granite, gypsum, mineral water, tin.

SACRAMENTO

Land area: 983 square miles.
Population: 141,915 (1930 census).
Location: North-central portion of state.
County seat: Sacramento.
References: State Mineralogist Report XV: XVII: XVIII: XX: XXI (Jan., 1925).

Sacramento stands seventeenth among the counties of the state as a mineral producer, the output, principally gold, for 1929 being valued at $2,247,302, as compared with the 1928 production worth $2,389,645. In regard to gold output alone, this county ranks fourth, being exceeded only by Yuba, Nevada and Amador counties, the Sacramento product coming from the dredges. Its mineral resources include brick, clay, gold, granite, natural gas, platinum, silver, and miscellaneous stone.

Commercial production for 1929 was as follows:

Substance	*Amount*	*Value*
Brick and hollow building tile	----	$228,312
Gold	----	1,492,083
Granite	----	6,726
Silver	2,886 fine oz.	1,538
Stone, miscellaneous	----	463,930
Other minerals*	----	54,713
Total value		$2,247,302

*Includes clay (pottery), lead, natural gas, platinum.

SAN BENITO

Land area: 1392 square miles.
Population: 11,310 (1930 census).
Location: West-central portion of state.
County seat: Hollister.
References: State Mineralogist Report XV: XVII: XVIII: XX: XXII (April, 1926).

While nineteenth among the counties of the state in regard to value of total mineral production for 1929, San Benito has led for some years in one important branch of the mineral industry, namely, quicksilver. Cement is also an important item.

Its other mineral resources, many of them undeveloped, include antimony, asbestos, bituminous rock, chromite, coal, dolomite, gems, gypsum, limestone, magnesite, mineral water, and miscellaneous stone.

Commercial production for 1929 was as follows:

Unapportioned*	$1,908,462

* Includes cement, magnesite, quicksilver, miscellaneous stone.

SAN BERNARDINO

Land area: 20,157 square miles.
Population: 133,827 (1930 census).
Location: Southeastern portion of state.
County seat: San Bernardino.
References: State Mineralogist Report XV: XVII: XVIII: XIX: XX.

San Bernardino, by far the largest county in the state in area, ranks sixth as regards the value of its mineral output for 1929, with a total of $11,210,652, as compared with the 1928 total of $14,157,381. The decrease is mainly due to cement.

San Bernardino for several years (except 1918) has led all other counties in the state in point of variety of minerals, producing commercially during 1929 a total of 22 different substances. This county also ranks first as a silver producer in the state, from the mines of the Randsburg district.

This county, consisting largely of mountain and desert country, is highly mineralized, the following being included among its resources: Asbestos, barytes, borax, brick, cement, clay, copper, gems, gold, granite, gypsum, iron, lead, limestone, manganese, marble, mineral paint, mineral water, nitre, potash salt, soapstone, soda, miscellaneous stone, strontium, talc, tungsten, vanadium, and zinc.

Commercial production for 1929 was as follows:

Substance	*Amount*		*Value*
Cement	3,576,005	bbls.	$4,603,301
Clay (pottery)	2,596	tons	15,874
Copper	81,846	lbs.	14,405
Gems	--------		1,540
Gold	--------		44,984
Lead	53,532	lbs.	3,373
Lime	10,145	tons	77,340
Limestone	15,526	tons	40,752
Salt	24,949	tons	114,796
Silver	356,015	fine oz.	189,756
Stone, miscellaneous	--------		629,111
Other minerals*	--------		5,475,419
Total value			$11,210,652

* Includes barytes, borates, calcium chloride, manganese, mineral water, potash, volcanic ash, soda, talc, tungsten.

SAN DIEGO

Land area: 4221 square miles.
Population: 209,477 (1930 census).
Location: Extreme southwest corner of state.
County seat: San Diego.
References: State Mineralogist Report XIV: XVII: XVIII: XIX: XX: XXI (July, 1925).

San Diego ranks twenty-third in the total value of its mineral output for the year, with 16 different commercial minerals. The value for 1929 equaled $1,447,287 as compared with the 1928 output worth $1,770,253.

In the production of semiprecious gems, San Diego County has led the state. Aside from minerals commercially produced, as shown below, San Diego County contains occurrences of bismuth, lithia, marble, nickel, soapstone, and tin. Potash has been produced from kelp.

Commercial production for 1929 was as follows:

Substance	*Amount*	*Value*
Brick and hollow building tile	-----	$146,221
Clay (pottery)	20,148 tons	34,020
Fuller's earth	8,414 tons	78,944
Gems	-----	2,210
Gold	-----	1,282
Granite	-----	28,884
Silver	9 fine oz.	5
Stone, miscellaneous	-----	777,481
Other minerals*	-----	378,240
Total value		$1,447,287

*Includes bromine, feldspar, magnesium salts, mineral water, salt, silica, tube-mill pebbles.

SAN FRANCISCO

Land area: 46½ square miles.
Population: 637,212 (1930 census).
County seat: San Francisco.
References: State Mineralogist Report XVII: XVIII: XX: XXV (April, 1929).

Surprising as it may appear at first glance, San Francisco County is listed among the mineral producing sections of the state, actual production consisting mainly of crushed rock, sand and gravel. Small quantities of various valuable mineral substances are found here, including cinnabar, gypsum, lignite, and magnesite, none, however, in paying quantities. Some pumice has been produced.

In fiftieth place, commercial production for 1929 was as follows:

Substance	*Value*
Unapportioned	$75,245

SAN JOAQUIN

Land area: 1448 square miles.
Population: 102,871 (1930 census).
Location: Central portion of state.
County seat: Stockton.
References: State Mineralogist Report XIV: XVII: XVIII: XXI (April, 1925).

San Joaquin County reported a mineral production for the year 1929 having a total value of $789,891 as compared with the 1928 output worth $624,931.

Comparatively few mineral substances are found here, the chief ones being brick, clay, manganese, natural gas, glass-sand, and miscellaneous stone. Gold, platinum and silver have been obtained by dredging in the Mokelumne River, which forms the boundary between this county and Amador on the northeast.

In twenty-seventh place, commercial production for 1929 was as follows:

Substance	*Value*
Brick and hollow building tile	$607,469
Stone, miscellaneous	135,317
Unapportioned	47,105
Total value	$789,891

SAN LUIS OBISPO

Land area: 3334 square miles.
Population: 29,617 (1930).
Location: Bordered by Kern County on the east and the Pacific Ocean on the west.
County seat: San Luis Obispo.
References: State Mineralogist Report XV: XVII: XVIII: XXI (Oct., 1925).

The total value of the mineral production of San Luis Obispo County in 1929 was $191,084, as compared with the 1928 output, worth $217,125.

Among its mineral resources, both developed and undeveloped, are asphalt, bituminous rock, brick, chromite, coal, copper, diatomaceous earth, gypsum, iron, limestone, marble, mineral water, onyx, petroleum, quicksilver, soda and miscellaneous stone.

In forty-sixth place, commercial production for 1929 was as follows:

Substance	*Amount*	*Value*
Brick and hollow building tile	----	$31,320
Gold	----	1,267
Quicksilver	1,076 flasks	120,995
Silver	2 fine oz.	1
Stone, miscellaneous	----	11,061
Other minerals*	----	26,440
Total value		$191,084

* Includes chromite, granite (tuff), marble (flagstone), mineral water, petroleum, volcanic ash.

SAN MATEO

Land area: 447 square miles.
Population: 77,338 (1930 census).
Location: Peninsula, adjoined by San Francisco on the north.
County seat: Redwood City.
References: State Mineralogist Report XVII: XVIII: XXV (April 1929).

San Mateo's most important mineral products are cement, stone and salt, the last named being derived by evaporation from the waters of San Francisco Bay. The total value of all mineral production during 1929 equaled $3,672,779, as compared with the 1928 figures of $3,328,573, the increase being due to cement and miscellaneous stone.

Small amounts of barytes, chromite, infusorial earth, and quicksilver have been noted in addition to the items of economic value given below. Bricks have also been produced commercially.

In tenth place, commercial production for 1929 was as follows:

Substance	*Value*
Stone, miscellaneous	$278,839
Other minerals*	3,393,940
Total value	$3,672,779

* Includes cement, limestone, magnesium salts, natural gas, salt.

SANTA BARBARA

Land area: 2740 square miles.
Population: 65,075 (1930 census).
Location: Southwestern portion of state, adjoining San Luis Obispo on the south.
County seat: Santa Barbara.
References: State Mineralogist Report XV: XVII: XVIII: XIX: XXI (Oct., 1925).

Santa Barbara County owes its position of fifth in the state in regard to its mineral output to the presence of productive oil fields within its boundaries. The total value of its mineral production during the year 1929 was $16,407,136 as compared with the 1928 output of $4,577,650, and included eleven different mineral substances. The increase was due to petroleum and diatomaceous earth.

Aside from the mineral substances listed below, Santa Barbara County contains asphalt, gilsonite, gypsum, magnesite, and quicksilver in more or less abundance.

Commercial production for 1929 was as follows:

Substance	*Amount*	*Value*
Natural gas	1,291,786 M cu. ft.	$145,680
Petroleum	11,141,789 bbls.	13,984,055
Stone, miscellaneous		264,745
Other minerals*		2,012,656
Total value		$16,407,136

* Includes barytes, bituminous rock, brick and hollow building tile, diatomaceous earth, marble, mineral water.

SANTA CLARA

Land area: 1328 square miles.
Population: 144,921 (1930 census).
Location: West-central portion of state.
County seat: San José.
References: State Mineralogist Report XVII: XVIII: XX: XXVI (Jan., 1930).

Santa Clara County reported a mineral output for 1929 of $963,478 as compared with the 1928 figures of $1,021,541.

This county, lying largely in the Coast Range Mountains, contains a wide variety of mineral substances, including brick, chromite, clay, limestone, magnesite, manganese, mineral water, petroleum, quicksilver, soapstone, and miscellaneous stone.

In twenty-sixth place, commercial production for 1929 was as follows:

Substance	*Amount*	*Value*
Brick	14,063 M	$168,872
Clay (pottery)	13,799 tons	13,871
Mineral water	10,760 gal.	1,076
Stone, miscellaneous		332,902
Other minerals*		446,757
Total value		$963,478

* Includes limestone, magnesite, natural gas, petroleum, quicksilver, salt.

SANTA CRUZ

Land area: 435 square miles.
Population: 37,405 (1930 census).
Location: Bordering Pacific Ocean, just south of San Mateo County.
County seat: Santa Cruz.
References: State Mineralogist Report XVII: XVIII: XXII (Jan., 1926).

The mineral output of Santa Cruz County, a portion of which is itemized below, amounted to a total value of $3,327,633, giving the county a standing of twelfth among all others in the state in this regard. This is a slight increase from the 1928 figure of $3,323,920.

Commercial production for 1929 was as follows:

Substance	*Amount*	*Value*
Lime	10,075 tons	$112,761
Limestone	15,143 tons	40,786
Stone, miscellaneous	-----	75,250
Other minerals*	-----	3,098,836
Total value		$3,327,633

* Includes bituminous rock and cement.

SHASTA

Land area: 3858 square miles.
Population: 13,925 (1930 census).
Location: North-central portion of state.
County seat: Redding.
References: State Mineralogist Report XIV: XVII: XVIII: XIX: XXII (April, 1926).

Shasta County stood twenty-second in California among the mineral producing counties for 1929, with an output valued at $1,751,196, as compared with the 1928 production worth $1,104,727, the increase being due chiefly to copper.

The marked decrease since 1918 is due to the falling off in the output of copper, the large plants of the Mammoth and Mountain copper companies being shut down. Not taking petroleum into account, Shasta for a number of years led all of the counties by a wide margin, but in 1919–1923 was passed by San Bernardino, Plumas, Yuba, Inyo, Sacramento, Nevada, and Amador, among the 'metal' counties, though by only San Bernardino and Plumas of that group in 1925.

Shasta's mineral resources include asbestos, barytes, brick, chromite, coal, copper, gold, iron, lead, lime, limestone, mineral water molybdenum, pyrites, silver, soapstone, miscellaneous stone, and zinc.

Lassen Peak is located in southeastern Shasta County.

Commercial production for 1929 was as follows:

Substance	*Amount*	*Value*
Copper	6,066,098 lbs.	$1,067,633
Gold	--------	89,689
Silver	58,257 fine oz.	31,048
Stone, miscellaneous	--------	247,351
Other minerals*	--------	315,475
Total value		$1,757,196

*Includes asbestos, chromite, diatomaceous earth, platinum, pyrite.

SIERRA

Land area: 923 square miles.
Population: 2419 (1930 census).
Location: Eastern border of state just north of Nevada County.
County seat: Downieville.
References: State Mineralogist Report XVI: XVII: XVIII: XX: XXV (April, 1929).

Sierra County reported a mineral production of $390,402 mainly of gold and silver, during the year 1929, as compared with the 1928 output worth $679,925. Considering gold output this county stands sixth; and as to total mineral yield thirty-third.

Aside from the metals itemized below, Sierra County contains deposits of asbestos, chromite, copper, iron, lead, platinum, serpentine, and talc.

Commercial production for 1929 was as follows:

Substance	*Amount*	*Value*
Gold	----	$367,396
Silver	3,345 fine oz.	1,783
Stone, miscellaneous	----	21,223
Total value		$390,402

SISKIYOU

Land area: 6256 square miles.
Population: 25,505 (1930 census).
Location: Extreme north-central portion of state, next to Oregon boundary.
County seat: Yreka.
References: State Mineralogist Report XIV: XVII: XVIII: XIX: XX: XXI (Oct., 1925).

Siskiyou, fifth county in California in regard to size, located in a highly mineralized and mountainous country, ranks forty-fourth in regard to the value of its mineral output for 1929.

Although this county is traversed by a transcontinental railroad in a north and south line, the mineral-bearing sections are almost without exception far from transportation and other facilities. A large part of the county is accessible by trail only. Future development and exploitation will increase the productiveness of this part of the state to a considerable extent.

Mount Shasta is located in Siskiyou County.

Among Siskiyou's mineral resources are chromite, clay, coal, copper, gems, gold, lead, limestone, manganese, marble, mineral water, pumice, quicksilver, sandstone, silver, and miscellaneous stone.

Commercial production for 1929 was as follows:

Substance	*Amount*	*Value*
Copper	34,704 lbs.	$6,108
Gold	-----	63,843
Silver	1,619 fine oz.	863
Stone, miscellaneous	-----	110,878
Other minerals*	-----	48,097
Total value		$229,789

*Includes lead, limestone, mineral water, quicksilver.

SOLANO

Land area: 822 square miles.
Population: 40,807 (1930 census).
Location: Touching San Francisco Bay on the northeast.
County seat: Fairfield.
References: State Mineralogist Report XIV: XVII: XVIII: XXIII (April, 1927).

Solano, while mostly valley land, produced mineral substances during the year 1929 to the total value of $66,421, ranking fifty-first among the counties of the state, an increase from the 1928 figure of $57,451.

Among her mineral resources are brick, cement, clay, fuller's earth, limestone, mineral water, natural gas, onyx, quicksilver, salt and miscellaneous stone.

Commercial production for 1929 was as follows:

Substance	*Value*
Unapportioned*	$66,421

*Includes mineral water, onyx, travertine, miscellaneous stone.

SONOMA

Land area: 1577 square miles.
Population: 62,248 (1930 census).
Location: South of Mendocino County, bordering on the Pacific Ocean.
County seat: Santa Rosa.
References: State Mineralogist Report XIV: XVII: XVIII: XXII (July, 1926).

Sonoma ranked thirty-ninth among the counties of California during the year 1929, with a mineral production of $351,383, as compared with its 1928 output of $212,568. More paving blocks have been turned out here than in any other section of the state, but this industry has now ceased, owing to the construction of smooth-surface pavements both in the cities and on the highways.

Among Sonoma's mineral resources are brick, chromite, clay, copper, graphite, infusorial earth, magnesite, manganese, marble, mineral paint, mineral water, quicksilver, and miscellaneous stone.

Commercial production for 1929 was as follows:

Substance	*Amount*	*Value*
Mineral water	20,701 gals.	$7,376
Sandstone	-----	13,351
Stone, miscellaneous	-----	243,448
Other minerals*	-----	87,208
Total value		$351,383

*Includes chromite, gems, quicksilver.

STANISLAUS

Land area: 1450 square miles.
Population: 56,624 (1930 census).
Location: Center of state, bounded on south by Merced County.
County seat: Modesto.
References: State Mineralogist Report XIV: XVII: XVIII: XXI (April, 1925).

Gold has usually been the chief mineral product of Stanislaus County, but it was exceeded in 1918–1919 by manganese, and in 1921–

1923 and 1925–1929 by miscellaneous stone. Brick, clay, gypsum, mineral paint, quicksilver, and silver are found here to some extent as well. This county for 1929 ranks thirty-fourth in the state in regard to value of minerals, with an output of $388,235, as compared with $472,158 in 1928. Gold, platinum and silver are obtained mainly by dredging.

Commercial production for 1929 was as follows:

Substance	*Amount*	*Value*
Gold		$128,872
Silver		344
Stone, miscellaneous		233,325
Other minerals*		25,694
Total value		$388,235

SUTTER

Land area: 608 square miles.
Population: 14,618 (1930 census).
Location: Bounded by Butte County on the north and Sacramento on the south.
County seat: Yuba City.
References: State Mineralogist Report XV: XVII: XVIII.

Sutter is one of only two counties in the state which for a number of years reported no commercial output of some kind of mineral substance. In 1917 some crushed rock was taken out, from the Marysville Buttes, also in 1925–1928.

There has been some utilization of natural gas. There was no mineral production reported in 1929. Both clay and coal exist here, but deposits of neither mineral have been placed on a productive basis.

TEHAMA

Land area: 2893 square miles.
Population: 13,839 (1930 census).
Location: North-central portion of the state, bounded on the north by Shasta.
County seat: Red Bluff.
References: State Mineralogist Report XV: XVII: XVIII: XIX: XXIV (July, 1928).

Tehama stands fifty-sixth among the mineral producing counties of the state for 1929, when its output was valued at $14,480, as compared with the 1928 yield, worth $14,389.

Among its mineral resources are listed brick, chromite, copper, gold, manganese, marble, mineral water, salt, and miscellaneous stone.

The 1929 yield was distributed as follows:

Substance	*Value*
Stone, miscellaneous	$9,956
Other minerals*	4,524
Total value	$14,480

*Includes chromite and sandstone.

TRINITY

Land area: 3166 square miles.
Population: 2811 (1930 census).
Location: Northwestern portion of state.
County seat: Weaverville.
References: State Mineralogist Report XIV: XVII: XVIII: XIX: XX: XXII (Jan., 1926).

Trinity, like its neighbor, Siskiyou County, requires transportation facilities to further the development of its many and varied mineral resources. Deposits of asbestos, barytes, chromite, copper, gold, mineral water, platinum, quicksilver, silver, and building stone are known here, but with the exception of gold, chromite, copper, quicksilver and platinum, very little active production of these mineral substances has been made as yet.

The 1929 output of $525,874 shows a decrease from the 1928 figure of $530,180, due to gold, giving the county rank of thirtieth for the year.

Commercial production for 1929 was as follows:

Substance	*Amount*	*Value*
Copper	615,579 lbs.	$108,342
Gold	------	352,029
Silver	19,266 fine oz.	10,269
Stone, miscellaneous	------	41,867
Other minerals*	------	13,367
Total value		$525,874

*Includes chromite, coal, quicksilver.

TULARE

Land area: 4856 square miles.
Population: 77,375 (1930 census).
Location: Bounded by Inyo on the east, Kern on the south, Fresno on the north.
County seat: Visalia.
References: State Mineralogist Report XV: XVII: XVIII: XX.

Tulare stands fortieth on the list of mineral producing counties, the decrease from the 1929 value being due mainly to granite and miscellaneous stone.

This county's mineral resources, among others, are brick, clay, copper, feldspar, graphite, gems, limestone, magnesite, marble, quartz, glass-sand, soapstone, miscellaneous stone, and zinc. Tulare for a number of years led the state in magnesite output, except in 1918, when it was passed by Napa County, and since 1921 by Santa Clara.

Commercial production for 1929 was as follows:

Substance	*Value*
Stone, miscellaneous	$24,932
Other minerals*	262,949
Total value	$287,881

*Includes brick, granite, limestone, magnesite.

TUOLUMNE

Land area: 2190 square miles.
Population: 9239 (1930 census).
Location: East-central portion of state—Mother Lode District.
County seat: Sonora.
References: State Mineralogist Report XIV: XVII: XVIII. XIX: XX: XXIV (Jan., 1928).

Tuolumne ranks thirty-sixth among counties of the state relative to its total value of mineral output for 1929. This county ranks first as a producer of marble in the state. The mineral production for 1929 was valued at $371,520 compared with $376,278 in 1928.

Chromite, clay, copper, gold, lead, limestone, marble, mineral paint, platinum, soapstone, silver, and miscellaneous stone are among its mineral resources.

Commercial production for 1929 was as follows:

Substance	*Amount*	*Value*
Copper	82,383 lbs.	$14,499
Gold	-----	70,957
Silver	5,132 fine oz.	2,735
Stone, miscellaneous	-----	11,415
Other minerals*	-----	271,914
Total value		$371,520

*Includes dolomite, lead, lime, limestone, marble, slate.

VENTURA

Land area: 1878 square miles.
Population: 54,577 (1930 census).
Location: Southwestern portion of state, bordering on Pacific Ocean.
County seat: Ventura.
References: State Mineralogist Report XV: XVII: XVIII: XX: XXI (April, 1925).

Ventura is third county in the state in respect to the value of its mineral output for 1929. Its value passed that of Orange County, which for many years held this position. The 1929 mineral production was worth $34,043,899 as compared with the 1928 output worth $31,116,675, the increase being due to petroleum.

Commercial production for 1929 was as follows:

Substance	*Amount*	*Value*
Brick and hollow building tile	----------	$76,795
Clay (pottery)	232,886 tons	197,152
Gold	----------	473
Granite (flagstone)	----------	13,500
Natural gas	77,293,145 cu. ft.	5,812,729
Petroleum	24,003,969 bbls.	27,602,164
Silver	6 fine oz.	3
Stone, miscellaneous	----------	255,183
Unapportioned	----------	55,900
Total value		$34,043,899

YOLO

Land area: 1017 square miles.
Population: 23,618 (1930 census).
Location: Sacramento Valley, bounded by Sutter on the east and Colusa on the north.
County seat: Woodland.
References: State Mineralogist Report XIV: XVII: XVIII.

The mineral production from Yolo County during the year 1929 consisted entirely of miscellaneous stone, valued at $14,400, ranking it in fifty-seventh place. Deposits of undetermined value of iron and sandstone have been discovered within the confines of this county. Quicksilver has also been produced.

YUBA

Land area: 639 square miles.
Population: 11,327 (1930 census).
Location: Lies west of Sierra and Nevada counties; south of Plumas.
County seat: Marysville.
References: State Mineralogist Report XV: XVII: XVIII: XX: XXVI (July, 1930).

Yuba is twentieth of the mineral producing counties of the state, and has been first as a gold producer from 1925–1928, but was passed by Nevada, Amador, and Sacramento counties in the output of that metal in 1929. Iron and clay deposits have been reported in this county aside from the following commercial production shown for the year 1929. The decrease from the 1928 figure of $2,529,076 was due mainly to gold obtained by the dredgers, which also yield silver and platinum. The 1921 dredge yield of gold was a record for the county.

The 1929 production of Yuba County was distributed as follows:

Substance	*Amount*	*Value*
Gold	----	$1,456,039
Silver	4,968 fine oz.	2,648
Stone, miscellaneous	----	364,326
Other minerals	----	7,358
Total value		$1,830,371

CHAPTER VIII

DIRECTORY OF PRODUCERS OF METALLIC AND NON-METALLIC MINERALS IN CALIFORNIA, 1929

Note—The producers of natural gas and petroleum will be found in the Quarterly Summary of Operations, California Oil Fields, for July, August and September, 1929 (Vol. 15, No. 1).

ASBESTOS

	Product	Adddress	Mine
Shasta County			
Sinclair-Wolfe Co.		Foot of 22d Ave., Oakland	

BARYTES

	Product	Address	Mine
Mariposa County			
National Pigments Co.		Russ Bldg., San Francisco	El Portal
Nevada County			
Democrat Barite Mine, Chemical & Pigment Co., Inc.		766 50th Ave., Oakland	Bear River
San Bernardino County			
John Kennedy		Daggett	Daggett
Ellis Mallery		214 H. W. Hellman Bldg., Los Angeles	Barstow
Santa Barbara County			
La Brea Barytes Co., Inc., Wm. E. Smith, Mgr.		449 Church St., Santa Maria	La Brea

BITUMINOUS ROCK

	Product	Address	Quarry
Santa Barbara County			
Higgins Quarry, A. Satler, lessee		Carpinteria	Carpinteria
Santa Cruz County			
Bitumen Mines Operation, John De Bruynkops		839 Post St., San Francisco	Gordola

BORATES

	Product	Address	Plant
Inyo County			
Pacific Alkali Co.		1209 Pacific Mutual Bldg., Los Angeles	
Rasor Borate Lease, C. M. Rasor		Care of Pac. Coast Borax Co., 1014 Cent. Bldg., Los Angeles	Death Valley

BORATES—Continued

	Product	Address	Plant
Kern County			
Pacific Coast Borax Co.		1014 Central Bldg., Los Angeles	Kramer
Suckow Borax Mines Co., Inc., Dr. John Suckow		Muroc	Muroc
Western Borax Co.		P. O. Box 37, Murco	Muroc
San Bernardino County			
Amer. Potash and Chemical Corp.		Trona	Trona

BROMINE

	Product	Address	Plant
San Diego County			
California Chemical Corp.		111 Sutter St., San Francisco	San Diego

CALCIUM CHLORIDE

	Product	Address	Plant
San Bernardino County			
California Rock Salt Co.		2465 Hunter St., Los Angeles	Amboy
Saline Products, Inc.		2000 Santa Fe Ave., Los Angeles	Amboy

CEMENT

	Product	Address	Plant
Calaveras County			
Calaveras Cement Co.		315 Montgomery St., San Francisco	San Andreas
Contra Costa County			
Henry Cowell Lime and Cement Co.		2 Market St., San Francisco	Cowell
Kern County			
Monolith Portland Cement Co.		Bartlett Bldg., Los Angeles	Monolith

CEMENT—Continued

	Product	Address	Plant
Merced County			
Yosemite Portland Cement Co.	----------	Merced	Merced
Riverside County			
Riverside Cement Co.	----------	621 S. Hope St., Los Angeles	Riverside
San Benito County			
Pacific Portland Cement Co.	----------	Hunter-Dulin Bldg., San Francisco	San Juan
San Bernardino County			
California Portland Cement Co.	----------	1228 Pac. Mutual Bldg., Los Angeles	Colton
Riverside Cement Co., John Treanor, Pres.	----------	621 S. Hope St., Los Angeles	Oro Grande
Southwestern Portland Cement Co.	----------	605 H. W. Hellman Bldg., Los Angeles	Victorville
San Mateo County			
Pacific Portland Cement Co.	----------	111 Sutter St., San Francisco	Redwood City
Santa Cruz County			
Santa Cruz Portland Cement Co.	----------	Crocker Bldg., San Francisco	Davenport

CHROMITE

	Product	Address	Mine
San Luis Obispo County			
Mutual Mine, P. A. H. Arata	----------	San Luis Obispo	Goldtree
Shasta County			
Antone Orsini	----------	Box 170, Redding	----------
Sonoma County			
Alex Guthrie	----------	Hilton	Hilton
Tehama County			
State Chrome Mine, Savage Bros., lessee	----------	Red Bluff	Elder Creek
Trinity County			
Jack Mattos & A. Yolonte	----------	Castella	Crows Crest

CLAY

(Including producers of crude clay and manufacturers of brick, tile, porcelain, etc.)

	Product	Address	Plant
Alameda County			
Ryan Ranch Clay Pit, Alameda Clay Co.	c	R. 333 First National Bldg., Oakland	Testa
California Faience Co.	a	1335 Hearst Ave., Berkeley	Berkeley
N. Clark & Sons	a, b, c	116 Natoma St., San Francisco	Oakland
Livermore Fire Brick Work and California Brick Plant, W. S. Dickey Clay Mfg. Co.	a, b, c	Rialto Bldg., San Francisco	Livermore & Fabrico
Electrical Porecelain Works	a	2416 6th St., Berkeley	Berkeley
Hidecker Tile Co.	a	24th and Union Sts., Oakland	Oakland
Interlocking Tile Co.	a, c	Niles	Niles
Kraftile Co., L. J. Layton	a	55 New Montgomery St., San Francisco	Niles
M. & S. Tile Co., Geo. A. Smith and J. M. Muneze	a, c	Decoto	Decoto
Muresque Tiles, Inc.	a	503 Merchants Exchange Bldg., San Francisco	Oakland
Remillard Brick Co., R. C. Giroux, Secy.	b	332 Phelan Bldg., San Francisco	Pleasanton
Technical Porcelain and China Ware Co.	a	420 Kains Ave., Albany, via Berkeley, Cal.	Albany
Thomas Handmade Roofing Tile Co.	a, c	Decoto	Decoto
Western Clay Products (Formerly Calif. Pottery Co.	a, c	2265 E. 12th St., Oakland	Niles
Emerville Porcelain Works, Westinghouse Elec. and Mfg. Co.	a	East Pittsburgh, Pa.	Emeryville
Walrich Pottery	a	1285 Hearst Ave., Berkeley	Berkeley
Woolenius Tiles and Mantels	a	1631 Woolsey, Berkeley	Berkeley
Amador County			
M. J. Bacon	c	Ione	Carbondale
California Min. Products Co.	f	Kohl Bldg., San Francisco	Ione
Carlyle Clay Deposits, E. E. Tremain	c	Buena Vista, via R. F. D., Ione	Buena Vista
N. Clark & Sons	c, f	116 Natoma St., San Francisco	Ione
Ione Clay Pit, W. S. Dickey Clay Mfg. Co.	c, f	Rialto Bldg., San Francisco	Ione
Ione Fire Brick Co., J. T. Roberts, Mgr.	b	1267 Russ Bldg., San Francisco	Ione
Ione Clay and Sand Co., Cal. Mineral Products Co.	c	Kohl Bldg., San Francisco	Ione
Newman Clay Co., Newman Estate	c	Ione	Ione
Preston School of Industry	b	Ione	Ione
Butte County			
Lund Clay Plant	b	Oroville	Palermo
Calaveras County			
Western Clay Products	c	2265 E. 12th St., Oakland	Valley Spring

a. Clay products. b. Brick and hollow building tile. c. Crude clay. f. Fire sand.

	Product	Address	Plant
Contra Costa County			
California Art Tile Co., J. W. Hislop, Mgr.	a	Box 1116, Richmond	Richmond
Clark Shale Deposit, N. Clark & Sons	c	116 Natoma St., San Francisco	Walnut Creek
Mastercraft Tile and Roofing Co.	c	1 20th St., Richmond	San Pablo
Port Costa Brick Works, C. G. Berg, Pres.	b	6th and Berry Sts., San Francisco	Port Costa
Potters, Inc.	a	Kearney and Manila Sts., El Cerrito	El Cerrito
Richmond Pressed Brick Co.	a, b	625 Market St., San Francisco	Richmond
Standard Sanitary Mfg. Co., F. A. Kales, Mgr.	a	Box W, Richmond	Richmond
Fresno County			
Craycroft Brick Co.	b	Griffith-McKenzie Bldg., Fresno	Fresno
Humboldt County			
J. D. Thompson Brick Co., J. D. Thompson, Mgr.	a, b, c	Box 16, Myrtle Ave., Eureka	Eureka
Imperial County			
Flynt Silica & Spar Co.	g	1047 Richmond St., Los Angeles	----------
Inyo County			
Commercial Minerals Co.	e	114 Sansome St., San Francisco	----------
Kern County			
Alluvial Silt Co., V. E. Britton	d	Muroc	Muroc
Bakersfield Sandstone Brick Co., Jas. Curran, Mgr.	b	Bakersfield	Bakersfield
Bakersfield Rock & Gravel Co.	d	Box 395, Sta. A, Bakersfield	----------
King Lumber Co.	b	1402 King St., Bakersfield	Bakersfield
Muroc Clay Co.	e	5525 Randolph St., Maywood, Cal.	Muroc
Mojave Clay Corp., W. A. Potter	c	510 Vincenta St., Berkeley	Mojave
Owl Truck Co.	d	120 N. Tomarind, Compton	----------
The Filtrol Co.	e	650 S. Spring St., Los Angeles	Saltdale
Los Angeles County			
Acme Brick Co.	b	Hillstreet Bldg., Los Angeles	Santa Monica
Alhambra Brick & Tile Co.	b, c	5547 Valley Blvd., Los Angeles	Los Angeles
Kilns, Inc., W. Boswell	----------	Alhambra	Alhambra and Santa Monica
American Refractories Co.	a, b	3232 Alosta St., Los Angeles	----------
Angulo Tile Plant, R. F. Angulo & Sons	a	Reseda	Reseda

a. Clay products. b. Brick and hollow building tile. c. Crude clay. d. Oil well drilling mud. e. Filtering clay g. Bentonite for oil well drilling mud.

CLAY—Continued

	Product	Address	Plant
Los Angeles County—Continued			
Art Tile Co.	a	2304 E. 52d St., Los Angeles	
Batchelder-Wilson Tile Co.	a	2633 Artesian St., Los Angeles	
J. A. Bauer Pottery Co., Inc.	a	415 W. Ave. 33, Los Angeles	
Bay Cities Roofing Co., Inc.	a	1724 Stanford St., Santa Monica	Santa Monica
Calco Tile Mfg. Corp.	a	South Gate	South Gate
California Brick & Tile Co.	b	6151 Kester Ave., Van Nuys	Van Nuys
Claycroft Potteries, Fred H. Robertson	a	3101 San Fernando Blvd., Los Angeles	
Compton Brick and Tile Co.	b	402 Pacific S. W. Bldg., Long Beach	Compton
Davidson Brick Co.	b, c	4701 Floral Dr., Los Angeles	
Eljer California Co.	a	4100 Alameda, Los Angeles	
Empire China Co.	a	Burbank	
Emsco Refractories Co.	b, c	8661 Dorothy Ave., South Gate	South Gate
Tropico, L. A. & S. M. Plants, Gladding McBean & Co.	a, b, c	660 Market St., San Francisco	Tropico, Los Angeles and Santa Monica
Italian Terra Cotta Co.	a	1149 Mission Rd., Los Angeles	
K & K Brick Co., C. J. Kuback, Pres.	b	801 Fidelity Bldg., Los Angeles	
K & M Pottery Co.	a	2318 E. 52d St., Los Angeles	
Long Beach Brick Co., Inc., H. A. Havner, Mgr.	b	154 Elm Ave., Long Beach	
Los Angeles Brick Co.	b	1078 Mission Rd., Los Angeles	
Malibu Potteries Co.	a, c	119 N. Larchmont St., Los Angeles	
Mission Brick Co.	b	15209 Sepulveda Blvd., Van Nuys	Van Nuys
Pacific Coast Concrete Co.	a	2357 E. 52d St., Los Angeles	Vernon
Pacific Clay Products	a, b, c	650 Chamber of Comm. Bldg., Los Angeles	Los Angeles and Los Nietos
Pomona Brick Co., Wm. McMullen, Mgr.	b	Pomona	Pomona
Pomona Tile Mfg. Co.	a	Pomona	Pomona
Poxon China Co., C. J. Poxon	a	5600 Miles Ave., Huntington Park	
Reness Tile Co., A. H. Reness	a	1259 17th St., Santa Monica	
Santa Catalina Island Co., Wm. Wrigley, Jr.	a, b, c	Avalon	Santa Catalina Is.
Santa Monica Brick Co.	a, b	816 W. 5th, Los Angeles	Santa Monica
St. Louis Fire Brick and Clay, Joseph Mesmer	a, b	3050 E. Slouson St., Los Angeles	
Security Roof Co.	a, c	1120 N. La Brea St., Los Angeles	Santa Monica
Simons Brick Co., Walter R. Simons	a, b, c	620 Chamber of Commerce Bldg., Los Angeles	
Spanish Tile Roofing Co., R. F. Stubver, Mgr.	a	6601 Wilbur, Reseda	Reseda
Standard Brick Co.	b	580 Chamber of Commerce, Los Angeles	
Torrance Brick Co.	b	Border St., Torrance	Torrance
Tudor Potteries	a	2406 E. 58th St., Los Angeles	Los Angeles
Vernon Potteries	a	2300 E. 52d St., Los Angeles	Vernon
Vitrefrax Company	b	5100 Pacific Ave., Los Angeles	Vernon
Western Brick Co.	a, b, c	586 Chamber of Commerce Bldg., Los Angeles	

a. Clay products. b. Brick and hollow building tile. c. Crude clay.

	Product	Address	Plant
Marin County			
McNear Brick Co.	b	946 Monadnock Bldg., San Francisco	McNears
Mendocino County			
W. N. Briggs	b	Ukiah	Ukiah
Merced County			
The California Pottery Co., V. H. Martin, Mgr.	a, b, c	Merced	Merced
Mono County			
California Quarries Corp.	c	1300 Quimby Bldg., Los Angeles	Laws
Monterey County			
Salinas Valley Clay Prod. Co.	a	Castroville	Castroville
Orange County			
American Fire Clay Co.	c	San Juan Capistrano	San Juan
Arnold Clay Mine, I. P. Arnold	c	El Toro	El Toro
Gladding, McBean & Co.	c	660 Market St., San Francisco	----------
La Bolsa Tile Co., A. N. Griffith	a, b, c	Rt. 1, Box 174, Huntington Beach	Smeltzer
Mission Clay Products Co.	a, c	Olive	Olive
Pacific Clay Products	c	650 Chamber of Commerce Bldg., Los Angeles	----------
Placer County			
Clay Corp. of Cal.	c	Lincoln	Lincoln
Gladding, McBean & Co.	a, b, c	5th floor, 660 Market St., San Francisco	Lincoln
Lincoln Clay Products Co., M. J. Dillman, Mgr.	c	Lincoln	Lincoln
Riverside County			
Alberhill Coal and Clay Co., Geo. C. Hill	c	Alberhill	Alberhill
Casa Blanco Tile Co.	a, c	Prado	Prado
Emsco Clay Co.	c	5701 S. Boyle Ave., Vernon	Corona
Gladding, McBean & Co.	a, b, c	660 Market St. San Francisco	Alberhill
Hancocks Brick Yard, C. P. Hancock & Son	b	4330 Lemon St., Riverside	Highgrove
Los Angeles Brick Co.	a, b, c	1078 Mission Rd., Los Angeles	Alberhill
Pacific Clay Products	c	650 Chamber of Commerce Bldg., Los Angeles	----------
H. Pate	a, c	Corona	Prado

a. Clay products. b. Brick and hollow building tile. c. Crude clay. d. Oil well drilling mud. e. Filtering clay.

CLAY—Continued

	Product	Address	Plant
Sacramento County			
Cannon & Co.	b	Box 281, Sacramento	Ben Ali
Grover Russi Clay Pit, Gladding McBean & Co.	c	660 Market St., San Francisco	White Rock
H. C. Muddox	a, b	30th and L Sts., Sacramento	----------
Panama Pottery Co.	a	Box 1478 R. F. D. No. 4, 24th St. Rd., Sacramento	----------
Sacramento Brick Co.	b	1400 Front St., Sacramento	----------
Valley Brick Co.	b	1917 Stockton Blvd., Sacramento	----------
San Bernardino County			
A. B. Clark	c	1211 Sun Finance Bldg. Los Angeles	Oro Grande
Gladding, McBean & Co.	c	660 Market St., San Francisco	Bryman
Hart Clay Co., H. F. Coors	c	519 S. Judah St. Inglewood	Goffs
Kennedy Clay Pit, John Kennedy	c	Daggett	Daggett
Standard Sanitary Mfg. Co., Pacific Mines, F. A. Kales, Mgr.	c	P. O. Box W, Richmond	Hart
San Diego County			
American Encaustic T. Co.	a, c	52d and Alameda Sts., Los Angeles	El Cajon
Atlas Brick and Clay Co.	a, b, c	3565 3d St., San Diego	Rose Canyon
Mosto Otaylite Deposit, General Petroleum Corp.	e	1003 Higgins Bldg., Los Angeles	Otay
Pacific Clay Products Co.	c	650 Chamber of Commerce Bldg., Los Angeles	Farr Station
Standard Oil of Cal.	e	Standard Oil Bldg., San Francisco	Palm Siding
Union Brick Co., J. W. Rice, Sec'y.	b	3565 3d St., San Diego	Rose Canyon
Vitrified Products Corp.	a, b, c	2841 Jefferson St., North San Diego	North San Diego
San Francisco County			
Jalanivich & Olsen	a	2930 Baker St., San Francisco	----------
San Joaquin County			
San Joaquin Brick Co., J. F. Stein Secy.	b	33 S. El Dorado St., Stockton	Stockton
Stockton Brick and Tile Co.	b	McKinley Ave., Stockton	Stockton
Stockton Fire Brick Co., John T. Roberts, Mgr.	b	Stockton	Stockton
San Luis Obispo County			
Gamble Brick Co.	b	Santa Maria	Santa Maria
San Luis Brick Works, Faulstick Bros.	b	San Luis Obispo	San Luis Obispo
San Mateo County			
West Coast Porcelain Co.	a	P. O. Box 46, Millbrae	Millbrae

a. Clay products. b. Brick and hollow building tile. c. Crude clay. d. Oil well drilling mud. e. Filtering clay.

CLAY—Continued

	Product	Address	Plant
Santa Barbara County			
Associated Clay Products, Elmer H. Whittaker, owner	a, b	124 E. Arrillaga St., Santa Barbara	
Santa Clara County			
Carroll Gravel Pit, R. D. Carroll	c	950 6th St., San Jose	San Jose
Garden City Pottery, N. J. Mahone	a	560 N. 6th St., San Jose	San Jose
Handcraft Tile Co., L. W. Austin et al	a	Rt. 2, Box 121A, San Jose	San Jose
Kartschoke Clay Prod. Co.	a, c	1098 S. 3d St., San Jose	San Jose
James A. Le Mieux	c	Box 341, Senter Rd., San Jose	San Jose
Remillard Brick Co.	b	332 Phelan Bldg., San Francisco	San Jose
San Jose Brick Co.	b, c	P. O. Box 274, San Jose	
S & S Tile Co.	a	1881 S. First St., San Jose	
Stanislaus County			
Coopertown Clay Deposit, G. L. Fox	c	P. O. Box 843, Stockton	Coopertown
Tulare County			
S. P. Brick and Tile Co., W. D. Trewhitt, Mgr.	b	1561 Pacific Southwest Bldg., Fresno	Exeter
Ventura County			
Anderson & Hardison Press Brick Co., J. C. Hardison and G. A. Anderson	b, d	Santa Paula	Santa Paula
Peoples Lumber Co. J. M. Sharp, Mgr.	a, b, c	1102 Meta St., Ventura	Ventura
Selby Shale Pit, Mrs. Marjorie Selby	c	R. F. D. 1, Box 41 Ventura	Ventura
Dent Clay Pit Shell Oil Co.	d	Shell Bldg., San Francisco	Ventura

a. Clay products. b. Brick and hollow building tile. c. Crude clay. d. Oil well drilling mud. e. Filtering clay.

COAL

	Product	Address	Mine
Amador County			
Buena Vista Coal Mg. Co., J. J. Morras, Supt.		Ione, c/o R. F. D.	Buena Vista
Trinity County			
Big Bar Coal Mine, E. O. Klipphahn		Big Bar	Big Bar

COPPER

Principal Copper Producers in California in 1929

Mine	Operator	Address	Location
Alameda County			
Leona Heights and Alma	Blowski Copper Co.	1328 Trestle Glen Rd., Oakland	Oakland
Calaveras County			
Calaveras	Calaveras Copper Co.*	Copperpolis	Copperopolis
Calaveras	Engels Copper Co.	Mills Bldg., San Francisco	Copperopolis
Penn	Mateo Mining Co., R. C. Lane, Secy.	P. O. Box "O," San Mateo	Campo Seco
Humboldt County			
Horse Mountain	Horse Mtn. Copper Co.	Second and E Sts., Eureka	Blue Lake
Mono County			
Comanche	Comanche Mng. & Red. Co.	714 W. 10th St., Los Angeles	Benton
Plumas County			
Engels	Engels Copper Mng. Co.	Mills Bldg., San Francisco	Engelmine
Walker	Walker Mining Co.	Kearns Bldg., Salt Lake City, Utah	Spring Garde
San Bernardino Co.			
Anchor	New Trail Mining Co., J. F. Kent, Pres.	521 Security Bldg., Los Angeles	Arno
Run Over	Exchequer Mines Co., Lionel Brooke	Goffs	Goffs
Shasta County			
Greenhorn	Greenhorn Mng. Co., Albert Hanford	Golden Eagle Hotel, Redding	French Gulch
Hornet	The Mountain Copper Co., Ltd., W. S. Howard	112 Market St., San Francisco	Matheson
Trinity County			
Island Mountain	Island Copper Co., E. R. Leach, Mgr.	715 Easton Bldg., Oakland	Island Mountain
Tuolumne County			
Oak Hill	Oak Hill Gold Mng. Co., Geo. H. Johnson, Asst. Sec.	1364 Oakland Ave., Oakland	Cooperstown

* Calaveras taken over by Engels Copper Co. in May.

DIATOMACEOUS EARTH

	Product	Address	Quarry
Fresno County			
Mineral Products Mfg. Co., T. H. Eliatt and L. J. Allen		3464 Ventura St., Fresno	
Monterey County			
Calatome Co., R. B. Hoffman et al.		Monterey	Monterey
Pacatome Co.		California and Montgomery Sts., San Francisco	Bradley
Santa Barbara County			
Celite Corp.		Lompoc	Lompoc
Shasta County			
General Kieselguhr Corp.		519 California St., San Francisco	Bartle

DOLOMITE

	Product	Address	Quarry
Inyo County			
Inyo Marble Co.		406 S. Main St., Los Angeles	Lone Pine
Monterey County			
Pacific Coast Steel Quarry, Bethlehem Ship Building Corp.		20th and Illinois Sts., San Francisco	Salinas
Tuolumne County			
U. S. Lime Products Corp.		58 Sutter St., San Francisco	Sonora

FELDSPAR

	Product	Address	Mine
Imperial County			
Flint Silica and Spar Co.		1047–61 Richmond St., Los Angeles	
Riverside County			
American Encaustic Tiling Co.		52d and Alameda Sts., Los Angeles	
San Diego County			
Elder Feldspar Mine, Geo. W. Elder		799 Oak St., San Francisco	Campo
Langer Silica Mine, Oscar Langer		Escondido	Escondido
Standard Sanitary Mfg. Co., Pacific Mines, F. A. Kales, Mgr.		P. O. Box W, Richmond	Campo

FULLER'S EARTH

	Product	Address	Pit
Inyo County			
Commercial Minerals Co.		310 Irving St., San Francisco	
Kern County			
Muroc Clay Co.		5525 Randolph St., Maywood	Muroc
The Filtrol Co.		650 S. Spring St., Los Angeles	Bena
San Diego County			
Mosto Otaylite Deposit, General Petroleum Corp. of California		1003 Higgins Bldg., Los Angeles	Otay
Standard Oil Co. of Cal.		Standard Oil Bldg., San Francisco	Palm Siding

	Product	Address	Mine
Butte County			
Wm. Fliedner		Route 1, Oroville	Cherokee
C. E. Grant		Cherokee, via Oroville	Cherokee
J. C. Milliron		236 N. Griffin Ave., Los Angeles	
Calaveras County			
Green Mtn. Mine, J. J. McSorley, Mgr.		Mokelumne Hill	Mokelumne Hill
Fresno County			
C. M. Carter		2332 Valdez St., Oakland	
Inyo County			
Rocky Mountain George		Beatty, Nev.	
Lake County			
Clear Lake Gem Mining Co., J. F. Garrette		Woodland	Clear Lake
San Bernardino County			
Franklin Heald		Fontana	Victorville
Pacific Minerals Ass'n., John W. Hilton		1024 Seventh St., Hermosa Beach	Death Valley
San Diego County			
Hercules Group, A. W. Pray		243 Kansas St., Escondido	Escondido
Pala Chief Mine, Frank A. Salmons, Owner		John D. Spreckels Bldg., San Diego	Pala
Victor Rene		Pala	Pala
J. W. Ware		1060 Sixth St., San Diego	Smith Mtn.
Sonoma County			
Healdsburg Gem Mine, C. Pierson and A. H. Flournoy		Healdsburg	

GOLD

Principal Gold Producers in California in 1929

Mine	Type of mine	Operator	Address	Location
Amador County				
Argonaut	a	Argonaut Mining Co.	Humboldt Bank Bldg., San Francisco	Jackson
Central Eureka	a	Central Eureka Mg. Co.	Hunter-Dulin Bldg., San Francisco	Sutter Creek
Couer Leonie & Aurora	a	Jack Howald	Pine Grove	Pine Grove
Fuller property	d	John J. Bernich	Jackson	Murphys Gulch
Kennedy	a	Kennedy Mng. & Mg. Co.	519 California St., San Francisco	Martell
Lancha Plana	e	Lancha Plana Gold Drdeging Co.	Comanche	Comanche
Lancha Plana Gravel Plant	f	Atkinson Construction Co., Guy F. Atkinson	Valley Springs	Valley Springs
Moore	a	Moore Mining Co., Finlay Cook, Secy.	Balboa Bldg., San Francisco	Jackson
Moore	c	Amador Reduction & Dev. Co. Crown L. Cooper	Jackson	Jackson
Butte County				
Johnston Rock Plant	b	Johnston Rock Co.	Chico	Chico
Shasta-Butte	e	Shasta-Butte Gold Dredging Co.	Oroville	Oroville
Calaveras County				
Black Wonder	a	Calaveras Mng. & Mg. Co., H. J. Ferguson, Secy.	184 S. 11th St., San Jose	Mitchell Mill
Milton	e	Milton Drdg. Co., Lawrence Gardella	Monadnock Bldg., San Francisco	Milton
Oro Y Plata	a	Union Cons. Mining Co., Geo. Searle, Secy	Alexander Bldg., San Francisco	Murphy
Royal	a	Royal Development Co.	Kohl Bldg., San Francisco	Milton
Vallecito Western	f	Vallecito Mining Co., Don Steffa	Vallecito	Vallecito
El Dorado County				
Rising Hope	f	T. J. Dillon & J. W. Orr	3000 S St., Sacramento	Placerville
Sliger	a	Sliger Gold Mining Co., H. W. Simpers, Secy.	Greenwood	Greenwood
Van Hooker	a	Placerville Gold Mng. C., John A. Flink	Box 512, Placerville	Placerville
Fresno County				
Service Rock Pit	b	Grant Service Rock Co. Cons.	Fresno	Fresno
Kern County				
Big Battle	a	Battle Lode Mining Co., Thomas R. McNab, Secy.	Roosevelt Bldg., Los Angeles	Randsburg
Keyes	a	Minaret Cons. Mining Co., Herbert H. Lee, Secy.	610 S. Broadway, Los Angeles	Isabella
Tropico	a	Tropico Mg. & Mg. Co., H. Clifford Burton, Mgr.	Rosamond	Rosamond
Yellow Aster	a	Yellow Aster Mg. & Mg. Co., W. F. Allen, Jr., Mgr.	Randsburg	Randsburg

a. Lode mine. b. Placer mine. c. Tailings dump. d. Pocket mine. e. Dredge. **f. Drift mine.**

Mine	Type of mine	Operator	Address	Location
Mariposa County				
Colorado	a	Belmont Metals Corp., J. C. Kemp Van Ee	381 Bush St., San Francisco	Mariposa
Feliciana	a	Feliciana Gold Mg. Co.	Phelan Bldg., San Francisco	Mariposa
Original	a	Original Mg. & Mg. Co., J. W. Warford, Supt.	Clearinghouse	Clearinghouse
Merced County				
Merced River	e	La Grange Gold Dredging Co.	La Grange	La Grange
Mono County				
Bodie & Standard	a	Sam C. Smith	Bodie	Bodie
Eva Belle	a	J. C. McMillan	132 North Ave. 56, Los Angeles	Laws
Sarita	a	Sarita Mg. & Power Co., Ltd., James A. Ford	Roosevelt Bldg., Los Angeles	Bridgeport
Napa County				
Palisades	a	Banner Dev. Co., Lloyd Root	57 Post St., San Francisco	Calistoga
Nevada County				
Ancho	a	Yellow Tiger Cons. Mg. Co., Gordon M. Bettles, Secy.	Box 863, Nevada City	Graniteville
Boundary	a	Wm. J. Condon	De Young Bldg., San Francisco	Grass Valley
Empire and North Star	a	Empire-Star Mines Co., Ltd., William O. Simkins	Mills Bldg., San Francisco	Grass Valley
Gaston	a	Rescue-Eula Mg. Co., Geo. Searle, Secy.	Alexander Bldg., San Francisco	Washington
Idaho Maryland	a	Idaho Maryland Mine Co., Errol MacBoyle, Mgr.	Hobart Bldg., San Francisco	Grass Valley
Kennebec	f	W. E. Moulton	French Corral	French Corral
Murchie	a	American Foundation Co.	P. O. Box 687, Nevada City	Nevada City
Randolph	a	Western Merger Mines Co., A. A. Codd, Pres.	Box 5021, Reno, Nevada	Nevada City
Quaker Hill	f	Thomas C. Botting, Agent	446 Broad St., Nevada City	Nevada City
Placer County				
De Maria	b	C. F. De Maria	Auburn	Michigan Bluff
Trixie	b	Andrew Fogarty	Dutch Flat	Dutch Flat

a. Lode mine. b. Placer mine. c. Tailings dump. d. Pocket mine. e. Dredge. f. Drift mine.

GOLD—Continued

Mine	Type of mine	Operator	Address	Location
Plumas County				
Engels	a	Engels Copper Mg. Co.	Mills Bldg., San Francisco	Engelmine
Standart	a	Yakima Mohawk Mg. Co., c/o John Sawbridge	Yakima, Washington	Greenville
Walker	a	Walker Mining Co.	Kearns Bldg., Salt Lake City, Utah	Spring Garden
Sacramento County				
Capital	e	Capital Drdg. Co., W. P. Hammon	Balfour Bldg., San Francisco	Folsom
Channel	f	Channel Mg. Co., Lewis H. McCann	918 12th St., Santa Monica	Folsom
Natomas	e	Natomas Co.	Forum Bldg., Sacramento	Natomas
San Bernardino County				
Kelly Rand	a	Consolidated Metals Corp.	Mills Bldg., San Francisco	Randsburg
Shasta County				
Iron Mt. No. 8	a	The Mountain Copper Co., Ltd., W. S. Howard	112 Market St., San Francisco	Matheson
Shasta-Butte	e	Shasta-Butte Gold Drdg. Co.	Oroville	Redding
Sierra County				
Brush Creek	a	Kate Hardy Mg. Co., Ben F. Ballard	754 State St., Santa Rosa	Goodyear's Bar
Original 16 to 1	a	Original 16 to 1, Inc.	607 Monadnock Bldg., San Francisco	Alleghany
Oro Flame & Bonanza King	a	John J. Cannell	Alleghany	Alleghany
Siskiyou County				
Hickox	a	Luther Hickox	Somesbar	Somesbar
Quartz Hill	b	H. G. Noonan	Scott Bar	Scott's Bar
Summerville	b	A. B. Farnsworth	Cecilville	Cecilville
Tony Lund	b	H. C. Benson Co.	American Bank Bldg., Portland, Ore.	Hornbrook
Stanislaus County				
Atlas Rock Pit	a	Atlas Rock Co., Alonzo W. Stone, Secy.	47 N. Grant St., Stockton	Oakdale
La Grange	e	La Grange Gold Dredging Co.	La Grange	La Grange
Trinity County				
Island Mountain	a	Island Copper Co., E. R. Leach, Mgr.	715 Easton Bldg., Oakland	Island Mountain
Lewiston	e	Mark L. Requa	111 Sutter St., San Francisco	Lewiston

a. Lode mine. b. Placer mine. c. Tailings dump. d. Pocket mine. e. Dredge. f. Drift mine.

GOLD—Continued

Mine	Type of mine	Operator	Address	Location
Trinity County—Continued				
Madrona	e	Madrona Dredging Co.	Junction City	Junction City
Trinity	e	Trinity Dredging Co., Mary E. Smith, Gen. Mgr.	Lewiston	Lewiston
Tuolumne County				
Eagle Shawmut	a	W. S. Findley	Yuma, Arizona	Chinese Camp
Oak Hill	a	Oak Hill Gold Mg. Co., Geo. H. Johnson, Asst. Secy.	1364 Oakland Ave., Piedmont	Coopertown
Sugarman-Niger	a	Sugarman Mines, Inc., R. H. Nelson, Mgr.	533 Roosevelt Bldg., Los Angeles	Sonora
Yuba County				
Gordon Valley	e	Dr. C. W. Evans	Modesto	Camptonville
Red Cross	a	Red Cross Mining Co., Edward S. Van Dyck, Pres.	620½ I St., Sacramento	Dobbins
Yuba	e	Yuba Consl., Hammon Eng. Co.	351 California St., San Francisco	Hammonton

a. Lode mine. b. Placer mine. c. Tailings dump. d. Pocket mine. e. Dredge. f. Drift mine.

GRANITE

Operator	Product	Address	Quarry
Fresno County			
Academy Granite		Clovis	Clovis
Superior Granite Co., Inc.		Clovis	Academy
Inyo County			
Bly Stone Co. (tuff)		1985 E. 16th St., Los Angeles	Round Valley
Lassen County			
Grieg Quarry, A. D. Grieg		Susanville	Susanville
Los Angeles County			
H. A. Jones		295 Grant St., Pasadena	
Arthur Kelly		2512 W. 7th St., Los Angeles	
Madera County			
McGilvray-Raymond Corp.		3 Potrero Ave., San Francisco	Raymond
Nevada County			
Netz Granite Quarry, Ludwig Netz		Nevada City	Nevada City
Placer County			
Alexson Granite Co.		Rocklin	Rocklin
A. Pernu Granite Quarries, Adolph Pernu		Rocklin	Rocklin
Rocklin Granite Co., H. Grindell		Rocklin	Rocklin
Union Granite Co., Mat Ruhkala		Rocklin	Rocklin
Plumas County			
Paul Sonognini		Chilcoot	Chilcoot
Riverside County			
N. B. Walters Quarry, N. B. Walters		28 Chapel St., Alhambra	Val Verde
Sacramento County			
Folsom State Prison		Represa	Represa
San Diego County			
American Marble & Granite Works		1212 E. 19th St., Los Angeles	Santee
Crystal Black Quarry, John Stridsburg		Escondido	Spooks Canyon
McGilvray-Raymond Corp., Lakeside Quarry		6785 Anderson St., Los Angeles	Lakeside
Magee Quarry, Robert J. McGee		Pala	Pala
Mission Silver-Gray Granite		3422 Union Pacific Ave., Los Angeles	Lakeside

GRANITE—Continued

Operator	Product	Address	Quarry
San Diego County—Continued			
Meyer Granite Quarry W. A. Meyer		Lakeside	Lakeside
Simpson-Pirnie Granite Co.		21st and N Sts., San Diego	Santee
Southern Cal. Granite Co.		3845 Imperial St., San Diego	Lakeside
San Luis Obispo County			
A. Carpentier & Empire Trading Co.		486 California St., San Francisco	
Tulare County			
California Quarry, McGilvray-Raymond Corp.		3 Potrero Ave., San Francisco	Porterville
Ventura County			
G. W. Dryden		Fillmore	Grimes Canyon
R. A. Rickie & Sons		Fillmore	Grimes Canyon

GYPSUM

Operator	Product	Address	Quarry
Imperial County			
Imperial Gypsum Quarry, Pac. Portland Cement		111 Sutter St., San Francisco	Westmoreland
Riverside County			
G. R. Freeman		Court House, Riverside	Corona
E. R. Nonhoff		1116 Ramona St., Corona	Corona
U. S. Gypsum Co.		1105 Edwards & Wildey Bldg., Los Angeles	Midland

LEAD

Mine	Operator	Address	Location
Inyo County			
Butte	Tonopah Banking Corp.	Beatty, Nevada	Ubehebe
Daniels	T. M. Daniels	3006 Royal St., Los Angeles	Shoshone
Estelle and Cerro Gordo	Estelle Mines Corp., Roy C. Troeger	649 S. Olive St., Los Angeles	Keeler
Lead Lode	J. W. Ehrman	Big Pine	Big Pine
McCrea Group	W. J. Wilkinson and McCrea Bros.	Beatty, Nev.	Chloride Cliff
Noonday	Tecopa Con. Mining Co.	Tecopa	Tecopa
Ophir	Engineers Exploration Co., W. H. Coons, Pres.	702 California Reserve Bldg., Los Angeles	Tecopa
Santa Rosa	J. R. Le Cyr	Keeler	Keeler
Silver Reef	H. C. Eldridge	1420 E. San Antonio St., San Jose	Keeler
Silver Spoon	Theo. Peterson	Darwin	Darwin
Slate Range	Slate Range Cons. Mg. Co., R. E. Galloway, Secy.	1710 Second St., Bakersfield	Trona
San Bernardino Co.			
Bonanza King	T. L. Bright	Goffs	Goffs
Horan	James T. Horan	Yermo	Yermo
King	W. E. King	Oro Grande	Oro Grande

Operator	Product	Address	Quarry
Butte County			
W. H. King	b	Pulga	Poe
Feather River Lime Quarry, W. S. McLean	b	1919 San Bruno Ave., San Francisco	McLean Spur
El Dorado County			
Diamond Springs Lime Co.	b	Diamond Springs	Diamond Springs
El Dorado L. and Min. Co., J. H. Bell, Receiver	b	Shingle Springs	Shingle Springs
Pac. Portland Cement Co. Cons.	b	111 Sutter St., San Francisco	
Inyo County			
Inyo Chemical Co.	b	Cartago	Cartago
Los Angeles County			
Torrance Lime and Fertilizer Co.	b	Torrance	Torrance
San Bernardino County			
Cal. Portland Cement Co.	a	1228 Pac. Mutual Bldg., Los Angeles	Colton
Chas. D. Chubbuck	a, b	5000 Worth St., Los Angeles	
Victorville Lime Rock Co.	b	2149 Bay St., Los Angeles	Victorville
San Mateo County			
Pacific Portland Cement Co.	b	111 Sutter St., San Francisco	San Mateo
Santa Clara County			
Bay Shell Co.	b	519 California St., San Francisco	Alviso
Santa Cruz County			
Henry Cowell Lime and Cement Co., W. H. George, Mgr.	a	2 Market St., San Francisco	Santa Cruz
Holmes Lime & Cement Co.	a	Division and De Haro Sts., San Francisco	Felton
Pacific Limestone Prod. Co.	b	Spring St., Santa Cruz	Santa Cruz
Santa Cruz Port. Cement Co.	b	Crocker Bldg., San Francisco	Davenport
Siskiyou County			
Hathaway Quarry, A. S. Hathaway	b	Etna Mills	Scott Valley
Mt. Shasta Lime Co., W. J. Chastain	b	Gazelle	Gazelle
Tulare County			
Kaweah Quarries, A. C. Root, Owner	b	Lemon Cove	Lemon Cove
Tuolumne County			
S. W. Lime Products Corp.	a, b	58 Sutter St., San Francisco	
Ventura County			
Papa Alta Lime & Fertilizer Co., Mrs. M. L. Franklin, Secy.	b	4336 Victoria Park Dr., Los Angeles	Santa Susana

a. Producer of burnt lime. b. Producer of limestone.

MAGNESITE

Operator	Product	Address	Mine
San Benito County			
Sampson Magnesite Co.		803 Balford Bldg., San Francisco	Sampson Park
Santa Clara County			
Western Magnesite Mine, C. S. Maltby, Lessee		1006 Humboldt Bank Bldg., San Francisco	Red Mountain
Stanislaus County			
California Magnesite Co.		1219 First National Bank Bldg., San Francisco	Red Mountain
Tulare County			
Sierra Magnesite Co.		111 Sutter St., San Francisco	Porterville

MANGANESE

Operator	Product	Address	Mine
Plumas County			
Feather River Manganese Mine, Geo. A. Moore & Co.		212 California St., San Francisco	
Riverside County			
Blue Chief Mine, C. M. Langdon		Blythe	Cox
Stanislaus County			
Buckeye Mine, J. W. Preston, Jr.		350 Post St., San Francisco	Vernalis

MAGNESIUM CHLORIDE

Operator	Product	Address	Plant
San Diego County			
California Chemical Corp.		111 Sutter St., San Francisco	San Diego
San Mateo County			
Marine Chemical Co., R. E. Clarke		South San Francisco	South San Francisco

MARBLE (Including Onyx and Travertine)

Operator	Product	Address	Quarry
Amador County			
California Carrara Marble, A. G. Dondero		2895 3d St., San Francisco	Pine Grove
Inyo County			
Inyo Marble Co.		406 S. Main St., Los Angeles	Lone Pine
Los Angeles County			
Western Quarries, Inc.		5104 Wilshire Blvd., Beverly Hills	
San Luis Obispo County			
F. H. Warde		118 State St., Santa Barbara	Santa Rita Grade
Santa Barbara County			
G. Antolini		111 E. Gutierrez St., Santa Barbara	Tijiguas
Solano County			
P. Grassi & Co.		1945 San Bruno Ave., San Francisco	Tolenas Springs
Tolenas Springs Onyx, L. Cardini		121 14th St., San Francisco	Tolenas Springs
Tuolumne County			
The Columbia Marble Co., R. H. Van Norden, Secy.		413 Rialto Bldg., San Francisco	Columbia

MICA

Operator	Product	Address	Mine
Imperial County			
C. E. Allebrand	----------	2710 Fredrick St., Los Angeles	Ogilby

MINERAL PAINT

Operator	Product	Address	Mine
Alameda County			
C. K. Williams & Co. of Cal.	----------	Shellmount Park, Emeryville	Leona Heights
Placer County			
J. L. Williams	----------	4 Federal Telegraph Bldg., Oakland	Forest Hill
Stanislaus County			
V. J. Winkler	----------	Knights Ferry	Knights Ferry

Operator	Product	Address	Spring
Butte County			
Polk Springs, Wm. Polk, Mgr.		Chico	Chico
Richardson Springs, Lee Richardson, Mgr.		Chico	Chico
Calaveras County			
Mok-Hill Mineral Spring, Zumwalt-Dahl-Zumwalt		Mokelumne Hill	Mokelumne Hill
Contra Costa County			
Alhambra Spring, L. M. Lasell		Martinez	
Fresno County			
Mercey Mineral Springs Co., F. J. Bourn, Pres.		810 California Bldg., Los Angeles	Los Banos
Lake County			
Adams Mineral Springs, Clarence Prather		Adams, via Middletown	Adams
Bartlett Spring Co.		163 Turk St., San Francisco	
Norman Mineral Springs, H. C. Norman, Mgr.		Middletown	Middletown
Witter Springs, Inc., J. A. Carroll, Pres.		62d and La Salle Sts., Chicago, Ill.	Witter Springs
Los Angeles County			
Cascade Water Co.		4556 York Blvd., Los Angeles	
Elysian Spring Water		1536 Baxter, Los Angeles	Los Angeles
Holly Springs Water Co.		2301 Holly Dr., Los Angeles	
La Vida Mineral Water Co.		927 West 2d St., Los Angeles	
Magnetic Spring Water Co.		936 Palm Ave., Sherman	
Mission Spring Water Co.		8938 Keith, Hollywood	
Mountain Spring Water Co.		226 S. Avenue 54, Los Angeles	
Pure-lax Mineral Water Co.		3640 Griffin, Los Angeles	
Rose Springs-California Spring Water Co.		4835 Pasadena Ave., Los Angeles	Los Angeles
Sparklett Bottled Water Co.		4500 York Blvd., Los Angeles	
Marin County			
Tamalpais Natural Mineral Water Springs, Borello Bros.		San Rafael	
Napa County			
G. Musante		Calistoga	Calistoga
Napa Soda Springs Co., G. H. T. Jackson		1142 Mission St., San Francisco	
Napa Vichy Springs, John Lepori		Napa	
Samuels Soda Springs, R. J. Little		Monticello	
Walters Mineral Water, St. Helena Bottling and Cold Storage Co.		St. Helena	

MINERAL WATER—Continued

Operator	Product	Address	Spring
Riverside County			
Beulah Springs, Oscar C. McNicholl		Arlington	Arlington
San Bernardino County			
Arrowhead Hot Springs, California Consolidated Water Co.		Washington St. and Compton Ave., Los Angeles	Arrowhead
San Diego County			
Buckman Springs		3984 Idaho St., San Diego	
El Granito Spr. Bottling Co.		3094 Commercial St., San Diego	El Cajon
Rock Springs Co., E. S. Walck		R. 2, Box 442, Escondido	Escondido
San Luis Obispo County			
Mary Hill Mineral Well Co., Fred Merckel		Paso Robles	Paso Robles
Santa Barbara County			
Veronica Mineral Springs Co.		699 Brannan St., San Francisco	
Santa Clara County			
Calaveras Water Co., G. W. Fieger		354 E. Santa Clara St., San Jose	
San Jose Water Co., Mr. C. Wood		397 N. 2d St., San Jose	
Siskiyou County			
The Shasta Water Co.		6th and Brannan Sts., San Francisco	Dunsmuir
Yreka Bottling Works, Fred J. Meamber, Prop.		Yreka	Little Shasta
Solano County			
Blue Rock Min. Water Co., Manuel Madrid		Vallejo	Vallejo
Sonoma County			
Agua Caliente Springs Co., T. H. Corcoran, Prop.		Agua Caliente	Agua Caliente
Boyes Springs Bottling Works, F. W. Peterson, Mgr.		Boyes Springs	Boyes Springs
Barcal Springs, John Kolling		Preston	Preston
Fetters Mineral Springs, George Fetters		Fetters Springs	Fetters Springs

PLATINUM

Operator	Product	Address	Mine
Sacramento County			
Natomas Company of California	----------	Natoma Division, Forum Bldg., Sacramento	Natoma
Shasta County			
Mike Malone	----------	Platina	Beegum Creek
Stanislaus County			
La Grange Gold Dr. Co., John Barker, Mgr.	----------	La Grange	La Grange
Yuba County			
Yuba Cons. Goldfields Co.	----------	Hammonton	Hammonton

POTASH

Operator	Product	Address	Plant
San Bernardino County			
American Potash and Chemical Co.	----------	Trona	Trona

PUMICE OR VOLCANIC ASH

Operator	Product	Address	Quarry
Fresno County			
Earlonite Mining Co., L. T. Bennett and Earl Bennett		P. O. Box 474, Selma	
Fort Miller Pumicite, A. H. McKenzie		Griffith-McKenzie Bldg., Fresno	Friant
Flint Silica & Spar Co.		1047 Richmond St., Los Angeles	
Inyo County			
Chas. Brown		Shoshone	
Kern County			
Cudahy Packing Co.		803 Macy St., Los Angeles	Ceneda
Mono County			
California Quarries Corp.		1300 Quinby Bldg., Los Angeles	Laws
San Bernardino County			
California Talc Co.		837 Jackson St., Los Angeles	
San Luis Obispo County			
Francis Cleaner Mine, M. L. Francis		R. F. D. 233, Paso Robles	Paso Robles

PYRITE

Operator	Product	Address	Mine
Alameda County			
Leona Chemical Co., D. A. McDonnell		Syndicate Bldg., Oakland	Leona Heights
Shasta County			
Mountain Copper Co., Wm. F. Kett, Mgr.		112 Market St., San Francisco	Matheson

Operator	Product	Address	Mine
Colusa County			
Elgin Mine, H. C. Warwick, Supt.		3769 Jackson St., San Francisco	Wilbur Springs
Manzanita Mine, John Andrews		260 California St., San Francisco	Wilbur Springs
Fresno County			
Archer Quicksilver Mine, Joseph Byles & Sons		Coalinga	Panoche
Mercer Mine, Wm. Biaggi		Auzerais Bldg., San Jose	Little Panoche Cr.
Kern County			
Santa Ana Mining Co., C. D. Holmes		1408 N. Main St., Santa Ana	Tehachapi
Lake County			
Anderson Mine, E. W. Schwartz		Middletown	Anderson Springs
Big Chief Mine, Luis Petriquin		Middletown	Anderson Springs
Helen Mine, H. W. Gould		Mills Bldg., San Francisco	Middletown
Konocti Mine, John Jago		Lower Lake	Lower Lake
Red Elephant Quicksilver Mng. Co., F. D. Sanders, Pres.		2715 Franklin St., San Francisco	Rief
Sulphur Bank Mine, F. W. Bradley		Crocker Bldg., San Francisco	Lower Lake
Napa County			
Aetna Mine, Henry J. Bartlett		Crocker Bldg., San Francisco	Pope Creek
Bella Oaks Mining Co., S. H. Wyckoff, Sec.		1015 First St., Napa	Rutherford
Knoxville Q. Mine, Geo. E. Gamble		Monticello	Knoxville
La Joya Mine, Acme Mining and Milling Co.		381 Bush St., San Francisco	
Oat Hill Mine, Norman B. Livermore		85 Second St., San Francisco	Oat Hill
Orange County			
F. B. Browning		Tustin	Tustin
San Benito County			
New Idria Quicksilver Mines, Inc.		408 Merchants Exchange Bldg., San Francisco	Idria
Stayton Quicksilver Mine, R. B. Knox		Hollister	Hollister
San Luis Obispo County			
Carson Mine, Ellard W. Carson		San Luis Obispo	Adelaide
Mahoney Quicksilver Mine, Premier Metals Corp.		Merchants Exchange Bldg., San Francisco	Adelaide
Oceanic Mine, H. W. Gould		Mills Bldg., San Francisco	Cambria
Rinconada Quicksilver Mine, Mercury Corp. of America		1415 Montana Ave., Santa Monica	Santa Margarita

QUICKSILVER—Continued

Operator	Product	Address	Mine
Santa Clara County			
Biaggi Mine, Wm. R. Biaggi		Auzerais Bldg., San Jose	Edenvale
New Almaden Mine, E. T. Haun, Lessee		Almaden	Almaden
Siskiyou County			
Mercury Mines, Eugean Aureguy		Mills Bldg., San Francisco	Hornbrook
Sonoma County			
Cloverdale Quicksilver Mine, Cavagnaro & Schor, Lessees		Cloverdale	Cloverdale
Trinity County			
Altoona Quicksilver		315 Montgomery St., San Francisco	Altoona

Operator	Product	Address	Plant
Alameda County			
Arden Salt Co.		Newark	Newark and Mt. Eden
California et al. Plants, Leslie-California Salt Co.		Alexander Bldg., San Francisco	
Oliver Salt Co.		Mt. Eden	Mt. Eden
Inyo County			
Sierra Salt Co.		512 S. Alameda, Los Angeles	Saline Valley
Kern County			
Consolidated Salt Co.		P. O. Box 28, Long Beach	Saltdale
Los Angeles County			
Long Beach Salt Co.		P. O. Box 28, Long Beach	Long Beach
Modoc County			
Surprise Valley Salt Works, Joshua H. Hutchinson		Box 26, Lake City	Lake City
Mono County			
J. W. Preston		Mono Lake	Mono Lake
Monterey County			
Monterey Bay Salt Co., E. C. Vierra, Mgr.		Moss Landing	Moss Landing
San Bernardino County			
California Rock-Salt Co.		2465 Hunter St., Los Angeles	Amboy
Saline Products, Inc.		2000 Santa Fe Ave., Los Angeles	Amboy
San Diego County			
Western Salt Co.		917 J. D. Spreckels Bldg., San Diego	San Diego
San Mateo County			
Leslie Salt Plant, Leslie-California Salt Co.		Alexander Bldg., San Francisco	Leslie
Stauffer Chemical Co.		636 California St., San Francisco	Redwood City
Santa Clara County			
Alviso Salt Co., V. S. Hardy, Pres.		Russ Bldg., San Francisco	Alviso

SANDSTONE

Operator	Product	Address	Quarry
Los Angeles County			
Bender Bros., W. H. Bender	----------	321 Grant St., Pasadena	Boquet Canyon
R. C. Cole & Co.	----------	7160 Beverly Blvd., Los Angeles	----------
P. L. Glove	----------	Chatsworth	Chatsworth
Frank Welsh	----------	8912 Sunset Blvd., Los Angeles	----------
West Coast Flagstone, Guy T. Felty	----------	1226 S. Bedford, Los Angeles	----------
Monterey County			
Carmel Stone Quarries, Arthur H. Anthony	----------	2752 Filbert St., San Francisco	Carmel
M. J. Murphy	----------	Monte Verde and Ninth Sts., Carmel	Carmel
Sierra Quarry, Harry Rogers	----------	Box 136, Carmel	Carmel
Andrew Stewart	----------	Carmel	Carmel Valley
Napa County			
H. F. Galbeath	----------	2134 Center St., Berkeley	----------
Sonoma County			
S. Cabrol	----------	Glen Ellen	Glen Ellen
Gerberding Quarry, J. S. Taylor Lessee	----------	124 Stanford St., Santa Rosa	Glen Ellen
Tehama County			
H. F. Galbeath	----------	2134 Center St., Berkeley	----------

SILICA

Operator	Product	Address	Mine
Contra Costa County			
Silica Co. of California, S. D. Miller, Pres.		Merchants Exchange Bldg., San Francisco	Brentwood
El Dorado County			
Snow Silica Deposit, Spicky Polish Corp., Owners		1401 3d St., San Francisco	Placerville
Imperial County			
Flint Silica and Spar Co.		1047-61 Richmond St., Los Angeles	
Mariposa County			
James H. Helm		Le Grand	White Rock
Monterey County			
Del Monte Products, A. J. Gunnell		Crocker Bldg., San Francisco	Del Monte
Placer County			
Harry McCormick		Alta	Alta
Riverside County			
American Encaustic T. Co.		52d and S. Alameda Sts., Los Angeles	Murrieta
San Jacinto Rock Products, G. W. Green		San Jacinto	San Jacinto
P. J. Weisel		La Habra	Corona
San Diego County			
Langer Silica Mine, Oscar Langer		Escondido	

SILLIMANITE—ANDALUSITE—CYANITE GROUP

Operator	Product	Address	Mine
Imperial County			
Vitrefrax Co.		5000 Pacific St., Vernon, Los Angeles	Ogilby
Mono County			
Champion Porcelain Co., Dr. J. A. Jeffery, Pres.		Butler Ave. and Grand Trunk R. R., Detroit, Mich.	Mocalno

SILVER

Principal Silver Producers in California in 1929

Mine	Type of mine	Operator	Address	Location
Amador County				
Argonaut	a	Argonaut Mining Co.	1404 Humbt. Bk. Bldg., San Francisco	Jackson
Central Eureka	a	Central Eureka Mg. Co.	111 Sutter St., San Francisco	Sutter Creek
Kennedy	a	Kennedy Mg. and Mg. Co.	519 California St., San Francisco	Martell
Inyo County				
Estelle & Cerro Gordo	c	Estelle Mines Corp., Roy C. Troeger	649 S. Olive St., Los Angeles	Keeler
Santa Rosa	c	J. R. Le Cyr	Keeler	Keeler
Mono County				
Comanche	c	Comanche, Mg. & Red. Co.	714 W. 10th St., Los Angeles	Benton
Napa County				
Palisade	b	Banner Dev. Co., Lloyd L. Root	57 Post St., San Francisco	Calistoga
Nevada County				
Empire and North Star	a	Empire Star Mines, Ltd., William A Simkins	648 Mills Bldg., San Francisco	Grass Valley
Idaho-Maryland	a	Idaho-Maryland Mines Co., Errol MacBoyle, Mgr.	Hobart Bldg., San Francisco	Grass Valley
Murchie	a	American Foundation Co.	P. O. Box 687, Nevada City	Nevada City
Plumas County				
Engels	d	Engels Copper Mg. Co.	Mills Bldg., San Francisco	Engel Mines
Walker	d	Walker Mining Co.	Kearns Bldg., Salt Lake City, Utah	Spring Garden
Sacramento County				
Natomas	d	Natomas Co.	Forum Bldg., Sacramento	Natomas
San Bernardino County				
Bonanza King	c	T. L. Bright	Goffs	Goffs
Kelly Rand	d	Consolidated Metals Corp.	Mills Bldg., San Francisco	Randsburg
Shasta County				
Iron Mt. and No. 8	d	The Mountain Copper Co., Ltd., W. S. Howard	112 Market St., San Francisco	Matheson
Trinity County				
Island Mountain	d	Island Copper Co., E. R. Leach, Mgr.	Easton Bldg., Oakland	Island Mountain
Tuolumne County				
Oak Hill	a	Oak Hill Gold Mg. Co., Geo. H. Johnson, Asst. Sec.	1364 Oakland Ave., Piedmont	Coopertown
Yuba County				
Yuba	a	Yuba Cons., Hammon Eng. Co.	351 California St., San Francisco	Hammonton

a. Gold. b. Silver. c. Silver-Lead. d. Copper.

SLATE

Operator	Product	Address	Quarry
El Dorado County			
Pacific Minerals, Inc.		332 10th St., Richmond	
Tuolumne County			
Witney Slate Quarry, W. S. McLean		1919 San Bruno Ave., San Francisco	Hetch Hetchy

SOAPSTONE AND TALC

Operator	Product	Address	Mine
Butte County			
W. H. King	a	Pulga	Pulga
McLean Talc Deposit, W. S. McLean	a	1919 San Bruno Ave., San Francisco	McLean Spur
El Dorado County			
Pacific Minerals Co., Ltd., Chas. S. Renwick	a	337 10th St., Richmond	Shrub
Inyo County			
American-Italian Talc Co., S. W. Pipin, Pres.	b	Box 203, Los Angeles	
Sierra Talc Co., Franklin Booth, Mgr.	b	401 Equitable Bank Bldg., Los Angeles	Keeler
Western Talc and Magnesite Co.	b	1901 E. Slauson Ave., Los Angeles	Death Valley
Los Angeles County			
R. C. Cole & Co., R. C. Cole, Mgr.	a	7160 Beverly Blvd., Los Angeles	
San Bernardino County			
California Talc Co.	b	837 Jackson St., Los Angeles	
Pacific Coast Talc Co.	b	2149 Bay St., Los Angeles	Silver Lake

a. Soapstone. b. Talc.

SODA

Operator	Product	Address	Plant
Inyo County			
Inyo Chemical Co.	----------	Cartago	Cartago
Natural Soda Products Co., W. W. Waterson	----------	Bishop	Keeler
Pacific Alkali Co.	----------	1206 Pacific Mutual Bldg., Los Angeles	----------
San Bernardino County			
West End Chemical Co.	----------	West End	Searles Lake

STONE, MISCELLANEOUS

Under the heading of stone, miscellaneous, there are four divisions—crushed rock, grinding mill pebbles, paving blocks, and sand and gravel.

Crushed rock includes all crushed rock that is used in macadam, ballast and for concrete; also rock used for rubble and riprap.

Operator	Product	Address	Location of Pit or Quarry
Alameda County			
Associated Gravel Co. *	b	704 Market St., San Francisco	
Bilger Property Co., Mr. F. W. Bilger	b	5000 Broadway, Oakland	Oakland
California Rock Co. *	a	Mills Bldg., San Francisco	Pleasanton
Central Construction Co., Leona Quarry and Heyland Quarry	b	Oakland Bank Savings Bldg., Oakland	Oakland
Coast Rock and Gravel Co. *	a	1000 Hunter-Dulin Bldg., San Francisco	Niles and Eliot
G & M Gravel Co. *	a	Builders Exchange Bldg., Oakland	Pleasanton
Hanifen Trucking Co.	a	Pleasanton	Pleasanton
Hayward Building Materials Co., Stevenson Gravel Pit	a	Atherton & Jackson Sts., Hayward	Centerville
J. F. Johnson	b	P. O. Box 232, Livermore	Livermore
Kaiser Construction Co.	a	American Bank Bldg., Oakland	Eliot
Kemper Bros.	b	Hayward	Hayward
Langdon Molding Sand, J. H. Langdon	c	R. F. D. Box 89, Niles	Decoto
Red Shale Quarry, W. S. McLean	d	1919 San Bruno Ave., San Francisco	Arroyo Mocho
Mtn. View Cemetery Assn.	b	Oakland	Piedmont
Pacific Coast Aggregates, Inc.	a, b	85 2d St., San Francisco	Eliot and Niles
Ramos Quarry, Ramos Bros.	a	C and 7th Sts., Hayward	Hayward
Rhodes Jamieson & Co., G. G. Jamieson, Gen. Mgr. *	a	Park and Blanding, Oakland	Eliot
Russell Bros. Quarry, B. and L. Russell	b	1192 Russell Way, Hayward, California	Hayward
San Leandro Rock Co., Lake Chabot Quarry	----------	1273 Foothill Blvd., San Leandro	Lake Chabot
Alpine County			
Alpine County	b	Markleeville	
Amador County			
Amador County	a, b	Jackson	
Pacific Gas and Elec. Co., Eng. Dept., Mr. Peterson	b	Market St., San Francisco	Salt Springs
Butte County			
Butte County	a, b	Oroville	
Refus Bean	a	Clipper Mills	Clipper Mills
Bechter-Kaiser Co., R. J. Kennedy, Mgr.	b	Oroville	Oroville
Coast Rock and Gravel Co.*	a, b	1000 Hunter-Dulin Bldg., San Francisco	Oroville
J. E. Johnston Rock Co.	a, b	Chico	Chico
McLean Quarry	d	1919 San Bruno Ave., San Francisco	McLean Spur
Pacific Coast Aggregates, Inc.	a, b	85 2d St., San Francisco	Oroville

a. Sand and gravel. b. Crushed rock (macadam, ballast, rubble, riprap, etc.). c. Molding sand. d. Granules for roofing, terrazzo. e. Slag. f. Tube mill pebbles. g. Decomposed granite.

* Consolidated with Pacific Coast Aggregates, Inc., Sept. 1, 1929.

STONE, MISCELLANEOUS—Continued

Operator	Product	Address	Location of Pit or Quarry
Calaveras County			
Calaveras County	b	San Andreas	
Pardee Dam, East Bay Mun. Utility Dist.	b	1924 Broadway, Oakland	Pardee Dam
Pacific Minerals, Inc.	d	337 10th St., Richmond	Angels
Colusa County			
Colusa County	a	Colusa	
Contra Costa County			
Contra Costa County	a	Martinez	
Antioch Sand Co.	a	312 Loew Bldg., San Francisco	Antioch
Blake Bros. Co., Anson S. Blake	b	204 Balboa Bldg., San Francisco	
Central Construction Co., Mr. C. D. Bates, Mgr.	b	Oakland Bank Savings Bldg., Oakland	Stege
Coburn Sand Plant, C. W. Coburn, Jr.	a	900 O'Farrell St., San Francisco	Antioch
Columbia Steel Co.	c	Pittsburg	Pittsburg
Brooks Island Quarry, Healy Tibbitts Const. Co., Mr. Chas. C. Horton, Pres.	----------	64 Pine St., San Francisco	Brooks Island
E. B. & A. L. Stone Co., Antioch Sand Pit	a	804 Claude Spreckels Bldg., San Francisco	Antioch
Morris Sand Pit, Ben Morris	a	Antioch	Antioch
Oak Point Sand Co.	a	Antioch	Antioch
Silico Co. of Calif., Ltd.	c	Merchants Exchange Bldg., San Francisco	Brentwood
Stege Quarry, Hutchinson Co.	b	1450 Harrison St., Oakland	Richmond and Stege
Del Norte County			
Del Norte County	a, b	Crescent City	
Webber Construction Co., H. Webber	a, b	Crescent City	
El Dorado County			
Diamond Springs Lime Co.	b	Diamond Springs	Diamond Springs
Morgan Rock Quarry, D. E. Douglas, Supt.	b	Georgetown	Georgetown
U. S. Forest Service	b	Ferry Building, San Francisco	
Fresno County			
Fresno County	a	Fresno	
Piedra Rock Quarry, Coast Rock and Gravel Co. *	b	1000 Hunter-Dulin Bldg., San Francisco	Piedra
Pacific Coast Aggregates, Inc.	b	85 2d St., San Francisco	Piedra
Service Rock Co.	a	T. W. Patterson Bldg., Fresno	El Prado
Southern California Edison Co.	b	Edison Bldg., Los Angeles	

a. Sand and gravel. b. Crushed rock (macadam, ballast, rubble, riprap, etc.). c. Molding sand. d. Granules for roofing, terrazzo. e. Slag. f. Tube mill pebbles. g. Decomposed granite.

* Consolidated with Pacific Coast Aggregates, Inc., Sept. 1, 1929.

Operator	Product	Address	Location of Pit or Quarry
Glenn County			
Southern Pacific R. R. Co., Asst. Chief Engr.	a	Southern Pacific Bldg., San Francisco	Wyo
Stony Creek Gravel Co., H. S. Tweed	a	Willows	Wyo
Humboldt County			
Humboldt County	a	Eureka	
W. C. Elsemore	a	332 W. Washington St., Eureka	
Engelhart Pav. and Construction Co.	a, b	Foot of S St., Eureka	Arcata
J. Ferguson	a	Arcata, R. F. D.	Arcata
Street Superintendent	a	Fortuna	Fortuna
Kern Construction Co., A. D. Kern	b	Trinidad	Trinidad
Mercer Fraser Co.	a	Second and Commercial Sts., Eureka	Essex & Fernbridge
Imperial County			
Imperial County	a, b	El Centro	
Dixieland Gravel Co., B. B. Whitelaw and E. S. Cook	a	El Centro	Dixieland
Imperial Irrigation Dist., Gen. Supt. River Div.	b	Andrade	Andrade
Imperial Rock Corp	b	P. O. Box 6, Niland	Niland
S. E. Layman	a	Holtville	Holtville
Potholes Granite Quarry, U. S. Bu. of Recl.	b	Winterhaven, c/o Yuma, Arizona	Winterhaven
Inyo County			
Inyo Marble Co.	b	406 S. Main St., Los Angeles	Lone Pine
Kern County			
Kern County	a	Bakersfield	
Bakersfield Rock and Gravel Co.	a, b	Box 395, Station A, Bakersfield	
Hartman Sand Plant, C. W. Hartman	a	Bakersfield	Kern River
Klassen Sand Pit, P. P. Klassen	a	1008 31st St., Bakersfield	Bakersfield
Lake County			
Lake County	a	Lakeport	
Chas. Kuppinger	a	Lakeport	Lakeport
Lassen County			
County Rock Crusher	b	Susanville	
Los Angeles County			
Associated Rock Co.	a	1000 N. La Brea St., Los Angeles	
A. T. & S. F. R. R., I. L. Hibbard, Gen Mgr.	a	609 Kerckhoff Bldg., Los Angeles	

a. Sand and gravel. b. Crushed rock (macadam, ballast, rubble, riprap, etc.). c. Molding sand. d. Granules for roofing, terrazzo. e. Slag. f. Tube mill pebbles. g. Decomposed granite.

STONE, MISCELLANEOUS—Continued

Operator	Product	Address	Location of Pit or Quarry
Los Angeles County—Continued			
Richard R. Ball	a, b	221 Ave. D, Redondo Beach	Torrance
Bengal & Sons	a	N. Santa Anita St., Pasadena	
Blue Diamond Co.	a, b	1650 S. Alameda St., Los Angeles	
Breslin Greenstone Quarry, Gene Breslin	d	Box 158, Palmdale	Harold
Concrete Materials Corp., F. M. McAvoy	b	P. O. Box 758, North Hollywood	
Consolidated Rock Products Co.	a, b	656 S. Los Angeles St., Los Angeles	Whittier & Fullerton
Ducey & Attwood Rock Co., R. K. Attwood, Sec. and Treas.	a, b	Box 194, La Manda Park	Pasadena
Eaton Canyon Rock and Sand Co.	a, b	2350 E. Colorado St., Pasadena	Pasadena
Catalina Island Quarry & Graham Sand Pit, Graham Bros.	a, b	Long Beach	Catalina Isl. & Roscoe
Livingston Rock and Gravel Co.	a, b	Valley Blvd. and Garfield Ave., Alhambra	San Gabriel Canyon
Rock and Gravel Plants, Los Angeles City Engineer's Office	a	Los Angeles	Los Angeles
Los Angeles Har. Dept., Bureau of Maintenance	b	City Hall, San Pedro	Santa Catalina
Los Angeles Decomposed Granite Co.	a, g	2171 W. Washington, Los Angeles	
Los Angeles Rock and Gravel	a, b	Box 3439 Pasadena Ave., Los Angeles	
Pavers Rock Co., Inc.	a, b	108 S. Central Ave., Glendale	Tujunga
Rancho Rock Plant	a	11970 W. San Fernando St., Burbank	Roscoe
Reynolds Crushed Gravel	a, b	920 N. Humphreys Ave., Los Angeles	
Santa Catalina Island Co.	a, b	Avalon	Santa Catalina Isl.
Sidebotham Sand Plants, Edwin Sidebotham and Son	a	Pennsylvania St., Lomita	Lomita
Sierra Rock & Materials Co., Geo. Wiegand, Mgr.	a, b	P. O. Box 206, El Monte	El Monte
Stine & Ellis Rock Prod. Co., W. L. Stine, Pres.	a	Burbank	Lankershim
Stein Sand and Gravel Co., R. O. Stein	a	Eighth St., Banning	Banning
Sunset Rock Products Co.	a, b	6372 Hollywood Blvd., Los Angeles	
Madera County			
Valley Feed & Fuel Co.	a, b	Merced	Madera & Chowchilla
Marin County			
Daniels Con. Co.	b	503 Market St., San Francisco	San Rafael
Hutchinson Company	b	1450 Harrison St., Oakland	San Quentin
Mariposa County			
Mariposa County	a	Mariposa	
Kelm Jasper Quarry, H. J. Kelm	d	Bagby	Bagby
Yosemite National Park	a, b	Yosemite	Yosemite Ntl. Park.

a. Sand and gravel. b. Crushed rock (macadam, ballast, rubble, riprap, etc.). c. Molding sand. d. Granules for roofing, terrazzo. e. Slag. f. Tube mill pebbles. g. Decomposed granite.

Operator	Product	Address	Location of Pit or Quarry
Mendocino County			
Mendocino County	a	Ukiah	----------
John Freitas	a	Ukiah	Ukiah
M. D. Perkins	a	Fort Bragg	Fort Bragg
Northwestern Pacific Ry. Co., G. W. Hicks, Chief Engineer	a	64 Pine St., San Francisco	South Park
Merced County			
Merced County	a	Merced	Los Banos
Hammatt Gravel Plant, V. M. Hammatt	a, b	Livingston	Livingston
Modoc County			
Modoc County	a	Alturas	----------
Mono County			
California Quarries Corp.	a	1300 Quimby Bldg., Los Angeles	Laws
Monterey County			
Del Monte Properties, A. J. Gunnell	a, c	401 Crocker Bldg., San Francisco	Pacific Grove
Wm. Machado	a	Box 424, Carmel	Carmel
Monterey Sand Co.	a	Monterey	Monterey
Pacific Coast Aggregates, Inc.	a	85 2d St., San Francisco	Lapis and Prattco
Pratt Bldg. Materials Co., Chas. F. Pratt, Gen. Mgr. *	a	Hearst Bldg., San Francisco	----------
Napa County			
Napa County	a, b	Napa	Napa
Basalt Rock Co., John Cassaretto	a, b	8th St. Napa; 6th and Channel St., San Francisco	----------
Errington Quarry, Ray Errington	a	Napa	Napa
John Fox	a	St. Helena	St. Helena
Lenz Rock Quarry, S. Lenz & Son	b	St. Helena	St. Helena
Butala Gravel Pit, S. F., Napa & Calistoga R. R.	a	Napa	St. Helena
Thorsen Gravel Pit, Harry Thorsen	a	St. Helena	St. Helena
Weinberger Gravel Pit, Mrs. H. E. Weinberger	a	St. Helena	St. Helena
Nevada County			
Nevada County	b	Nevada City	----------

a. Sand and gravel. b. Crushed rock (macadam, ballast, rubble, riprap, etc.). c. Molding sand. d. Granules for roofing, terrazzo. e. Slag. f. Tube mill pebbles. g. Decomposed granite.

* Consolidated with Pacific Coast Aggregates, Inc., Sept. 1, 1929.

STONE, MISCELLANEOUS—Continued

Operator	Product	Address	Location of Pit or Quarry
Orange County			
Orange County	----------	Santa Ana	Santa Ana
Bruce Bros.	g	Yorba Linda	Yorba Linda
Consolidated Rock Products Co.	a, b	656 S. Los Angeles St., Los Angeles	Whittier & Fullerton
Lindauer Corp.	a	200 W. Central Ave., La Habra	La Habra
Orange County Tile Co.	a	244 E. Amerige St., Fullerton	Anaheim
Reynolds Gravel Service	a	715 Hickory St., Santa Ana	Santa Ana
Sparkes & McClellan	a	R. 3, Box 244, Anaheim	Olive
Spurlock Sand Pit	a	Garden Grove	Garden Grove
Swartzbaugh Sand Pit	a	R. F. D. 2. Box 45 G, Orange	----------
Placer County			
Placer County	a	Auburn	Rocklin
Alexson Granite Co.	b	Rocklin	Rocklin
William Anderson	a	Rocklin	Rocklin
A. Pernu Granite Quarries, Adolph Pernu	b	Rocklin	Rocklin
Roseville Sand Co.	a	Roseville	Roseville
Rocklin Granite Co., H. M. Grindell	b	Rocklin	Rocklin
Plumas County			
U. S. Bureau of Public Roads	b	Sheldon Bldg., San Francisco	Morgan Spring and Spring Garden
Western Pacific R. R. Co., E. W. Mason, Gen. Supt.	b	Mills Bldg., San Francisco	----------
Riverside County			
Ormand Quarry, Hauser Construction Co.	b	Security Bldg., Long Beach	Bly Junction
Kuster & Waterburg	b	Corona	Corona
Langdon Schist Quarry, C. M. Langdon	b	Blythe	Cox
Nevada-Pacific Mineral Co., Inc.	b	3363 Fruitland Rd., Los Angeles	Grand Terrace
Palo Verde Commercial Co.	b	Blythe	Blythe
P. J. Weisel, Industrial Sands	a, c	La Habra	Corona
Sacramento County			
Cannon & Co.	c	Box 281, Sacramento	Ben Ali
Construction Materials Co.	a	24th St. and American River, Sacramento	American River
Fair Oaks Crusher, Coast Rock and Gravel Co. *	a, b	1000 Hunter-Dulin Bldg., San Francisco	Fair Oaks
Cutter Rock and Sand Co.	a, b	1401 39th St., Sacramento	American River
Del Paso Rock and Gravel Co.	b	H St. Rd., Sacramento	----------
Folsom State Prison	b	Represa	Represa
Pacific Coast Aggregates, Inc.	a, b	85 2d St., San Francisco	Fair Oaks, Mayhew and American River

a. Sand and gravel. b. Crushed rock (macadam, ballast, rubble, riprap, etc.). c. Molding sand. d. Granules for roofing, terrazzo. e. Slag. f. Tube mill pebbles. g. Decomposed granite.

* Consolidated with Pacific Coast Aggregates, Inc., Sept. 1, 1929.

Operator	Product	Address	Location of Pit or Quarry
Sacramento County—Continued			
Pratt Building Materials Co., Clarence F. Pratt, Gen. Mgr. *	a, b	Hearst Building, San Francisco	Sacramento, Mayhew
Rhodes, Jamieson & Co., G. G. Jamieson, Gen. Mgr. *	a	Park and Blanding Sts., Oakland	----------
San Benito County			
San Benito County	a	Hollister	----------
Granite Rock Co.	a, b	Drawer M, Watsonville	Logan
San Bernardino County			
Consolidated Rock Products Co.	a, b	656 S. Los Angeles St., Los Angeles	----------
Hanawalt Bros.,	a	La Verne	La Verne
V. P. Hunt	a	Redlands	Redlands
Los Angeles & Salt Lake R. R., Chief Engineer	b	Pacific Electric Bldg., Los Angeles	----------
Pacific Minerals, Inc.	d	337 10th St., Richmond	Barstow
San Bernardino Rock and Gravel Co.	a, b	941 E St., San Bernardino	San Bernardino
Triangle Rock and Gravel Co.	a	San Bernardino	----------
Declez Quarry, Vezu Bros.	b	Wineville	Declez
San Diego County			
Bulner & Murphy Rock Plant	a	310 4th St., San Diego	San Diego
Calaveras Rock Corp.	b	Oceanside	Oceanside
Canyon Rock Co.	a, b	3911 5th Ave., San Diego	San Diego
Challet & Brauley, Paul Challet	a	2155 Newton St., San Diego	San Diego
Cooper & Nelson	a	629 1st St., San Diego	San Diego
Daley Corp., George Daley	b	4440 Boundary St., San Diego	San Diego
A. W. Duquette	a	4465 Reed St., San Diego	San Diego
H. G. Fenton Material Co.	a, b	13th and Imperial Ave., San Diego	San Diego
R. E. Hazard Construction Co., Inc.	a, b	2548 Kettner Blvd., San Diego	Rancho Santa Fe
F. L. Hieatt	c	P. O. Box 865, San Diego	San Diego
R. M. Hubbard	c	406 W. Nutmeg St., San Diego	San Diego
Jones & Klinger, E. J. Klinger, Mgr.	a	Mission Valley, San Diego	Mission Valley
John T. Momand	f	Box 381, Carlsbad	Oceanside
National Sand Co., A. S. Johnson	a	Box 315, National City	National City
Nelson & Sloan	a	P. O. Box 585, Chula Vista	----------
Simpson-Pirnie Granite Co.	b	21st and N Sts., San Diego	Santee
Spreckels Commercial Co.	a	310 4th St., San Diego	----------
W. A. Thompson	c	3521 Eugene Pl., San Diego	----------

a. Sand and gravel. b. Crushed rock (macadam, ballast, rubble, riprap, etc.). c. Molding sand. d. Granules for roofing, terrazzo. e. Slag. f. Tube mill pebbles. g. Decomposed granite.
* Consolidated with Pacific Coast Aggregates, Inc., Sept. 1, 1929.

STONE, MISCELLANEOUS—Continued

Operator	Product	Address	Location of Pit or Quarry
San Francisco County			
Golden West Quarries	d	Visitacion, San Francisco	San Francisco
Mission Quarry Co.	d	210 Balboa Bldg., San Francisco	San Francisco
San Joaquin County			
Associated Gravel Co.*	a	704 Market St., San Francisco	Riverbank
Frank Marks	b	Newman	----------
Pacific Coast Aggregates, Inc.	a	85 2d St., San Francisco	Riverbank
Santa Fe Sand and Gravel Co., W. A. Arlington	a	P. O. Box 271, Escalon	Escalon
Southern Pacific R. R.	a	Southern Pacific Bldg., San Francisco	Tracy
San Luis Obispo County			
San Luis Obispo County	a	San Luis Obispo	----------
Guiton Molding Sand, Harold E. Guiton	c	Oceano	Oceano
Southern Pacific R. R. Co.	b	Southern Pacific Bldg., San Francisco	----------
San Mateo County			
San Mateo County	b	Redwood City	----------
H. E. Casey Co.	a, b	Third and B Sts., San Mateo	----------
Daly's Quarry, Market St. Ry. Co.	b	58 Sutter St., San Francisco	Daly
Holy Cross Cemetery	b	Colma	Colma
Industrial Mineral Products, W. B. Vestal	c	970 Seventh St., San Francisco	----------
Ratterree Bros Co.	b	400 Walbridge Blvd., San Francisco	South San Francisco
Santa Barbara County			
Gates Gravel Plant, Frank H. Gates	a	Santa Maria	Sisquoc
Midcoast Rock Co., Giovanola & West	b	19 E. Corrillo St., Santa Barbara	Pt. Honda
Santa Cruz Island Quarry, Seaboard Stone & Cons. Co.	b	P. O. Box 507, San Pedro	Santa Cruz Island
Lompoc, P. C. Schuch, St. Supt.	a	Lompoc	Lompoc
Southern Pacific R. R. Co., Asst. Chief Engineer	b	Southern Pacific Bldg., San Francisco	Arlight
U. S. Bureau of Public Roads	b	Sheldon Bldg., San Francisco	San Marcos
Santa Clara County			
County Surveyor, Santa Clara County	b	Hall of Records, San Jose	----------
G. H. Anderson	b	Mountain View, Santa Clara County	----------
Associated Gravel Co.*	a	704 Market St., San Francisco	Coyote Creek
Beasworrick Gravel Pit, Beasworrick Bros.	a	75 W. Howe St., San Jose	San Jose
Bright Gravel Co., William H. Bright	a	Delmas and Williams Sts. San Jose	Coyote Creek
Carroll Gravel Pit, R. D. Carroll	a	950 S. 6th St., San Jose	San Jose

a. Sand and gravel. b. Crushed rock (macadam, ballast, rubble, riprap, etc.). c. Molding sand. d. Granules for roofing, terrazzo. e. Slag. f. Tube mill pebbles. g. Decomposed granite.

* Consolidated with Pacific Coast Aggregates, Inc., Sept. 1, 1929.

Operator	Product	Address	Location of Pit or Quarry
Santa Clara County—Continued			
Stanford Quarry, Hutchinson Co.	b	1450 Harrison St., Oakland	Palo Alto
Jas. A. Lemieux	a	Box 341, Senter Rd., San Jose	San Jose
Los Gatos Sand and Gravel Co.	a	Los Gatos	Los Gatos
J. W. Lovejoy	b	Rt. 1, Box 88, Mountain View	Mountain View
Martin Bros.	a	1350 Alviso St., Santa Clara	Coyote Creek
Montoya Gravel Pit, M. Montoya	a	351 Keys St., San Jose	Coyote Creek
Pacific Coast Aggregates, Inc.	a	85 2d St., San Francisco	Coyote and Campbell
Prentiss Paving Co.	a	Fourth and Keys Sts., San Jose	San Jose
Raisch Imp. Co.	a	32 W. San Antonio St., San Jose	Coyote Creek
Ralph Richmond	a	910 California St., San Jose	Coyote Creek
Santa Clara Gravel Co.*	a	Campbell	Campbell
City of San Jose Sandpits, City Manager	----------	San Jose	Coyote Creek
Taaffe Construction Co.	b	Los Altos	Los Altos
Santa Cruz County			
Santa Cruz County	b	Santa Cruz	Felton
Mead Felton S. & G. Co., Harvey Mead	a	Felton	Felton
Geyer Gravel Plant, J. C. Geyer	a	Santa Cruz	----------
Olympic Sand Co.	a	1240 Russ Bldg., San Francisco	----------
Shasta County			
Shasta County	a, b	Redding	----------
Crews Gravel Pit, Philip Crews	a	17 N. Pine St., Redding	Sacramento River
Diestelhorst Gravel Plant, Chas. Diestelhorst	a, b	Redding	Redding
Southern Pacific R. R. Co., Asst. Chief Engineer	b	Southern Pacific Bldg., San Francisco	----------
Sierra County			
Sierra County	a	Downieville	----------
Nevada Construction Co.	b	Fallon, Nevada	----------
Siskiyou County			
Siskiyou County	a, b	Yreka	----------
A. Hoey Sand Pit, c/o A. F. Graham	a	Klamath Falls, Oregon	Hoey
Kaiser Paving Co.	b	American Bank Bldg., Oakland	----------
Southern Pacific R. R. Co., Asst. Chief Engineer	b	Southern Pacific Bldg., San Francisco	Kigg
Solano County			
Solano County	a	Fairfield	----------
Cordelia Rock Quarry, E. B. and A. L. Stone Co.	a	Claus Spreckels Bldg., San Francisco	Thomasson

a. Sand and gravel. b. Crushed rock (macadam, ballast, rubble, riprap, etc.). c. Molding sand. d. Granules for roofing, terrazzo. e. Slag. f. Tube mill pebbles. g. Decomposed granite.
* Consolidated with Pacific Coast Aggregates, Inc., Sept. 1, 1929.

STONE, MISCELLANEOUS—Continued

Operator	Product	Address	Location of Pit or Quarry
Sonoma County			
Sonoma County	b	Santa Rosa	
Hein Bros. Basalt Rock Co., Mark Hein, Pres.	b	Petaluma	Petaluma
Helberg Gravel Plant	a	Shellville	Shellville
Independent Gravel Co.	a	Forestville	Forestville
Mirabel Gravel Co.	a	Forestville	
Petaluma and Santa Rosa E. R. R., E. H. Maggard, Mgr.	b	Petaluma	Stony Point
Russian River Gravel Co., J. D. Grant, Mgr.	a	Healdsburg	Healdsburg
Sonoma Gravel Co., H. G. Burrowes	a	530 Mills Bldg., San Francisco	Geyserville
Stony Point Quarry, W. A. Wilson	b	Petaluma, Star Rt.	Stony Point
Stanislaus County			
A. T. & S. F. R. R., I. L. Hibbard, Gen. Mgr.	a	609 Kerckhoff Bldg., Los Angeles	
Atlas Rock Co.	a, b	47 N. Grant St., Stockton	Orange Blossom
W. Haslan	a	Oakdale	Oakdale
Frank B. Marks	a, b	Newman	Crows Landing
Modesto Sand Pit, City of Modesto	a	City Hall, Modesto	Modesto
Oakdale Irrigation Dist., M. E. Robinson, Auditor	a	Oakdale	Oakdale
Rinehart Sand Pit, Rinehart Bros.	a	Modesto	
Scanlon Gravel Plant, J. P. Scanlon	a	Patterson	Crows Landing
Stewart Gravel Pit, John Stewart	a	Crows Landing	Crows Landing
Tuolumne River Gravel Pit., Service Bros.	a	Waterford	Waterford
Tehama County			
Tehama County	a	Red Bluff	
Trinity County			
Trinity County	a	Weaverville	
Tulare County			
Tulare County	a	Visalia	
John R. White, Supt. Sequoia Natl. Park	a, b	Three Rivers	Sequoia Natl. Park
Tuolumne County			
Tuolumne County	a	Sonora	
McLean Quarry, W. S. McLean	d	1919 San Bruno Ave., San Francisco	Sonora
Tuolumne Natl. Marble Co., G. Bordoli	d	Box 513, Sonora	

a. Sand and gravel. b. Crushed rock (macadam, ballast, rubble, riprap, etc.). c. Molding sand. d. Granules for roofing, terrazzo. e. Slag. f. Tube mill pebbles. g. Decomposed granite.
* Consolidated with Pacific Coast Aggregates, Inc., Sept. 1, 1929.

STONE, MISCELLANEOUS—Continued

Operator	Product	Address	Location of Pit or Quarry
Ventura County			
Ventura County	b	Ventura	
El Rio Sand and Gravel Co.	a	2234 Thompson Blvd., Ventura	El Rio
Santa Clara Sand and Gravel Co.	a	2027 E. Main St., Ventura	Ventura
Santa Paula Rock Co.	a, b	Willard Bridge, Santa Paula	
Saticoy Rock Products Co.	a, b	Saticoy	Saticoy-Ventura
Ventura Velvet Molding Sand, Chas. A. Cole	c	1355 Church St., Ventura	Ventura
Yolo County			
Yolo County		Woodland	
Yolo Gravel Co.	a	P. O. Box 7, Yolo	Yolo
Yuba County			
Yuba River Sand Plant, Coast Rock and Gravel Co.*	a	1000 Hunter-Dulin Bldg., San Francisco	Marysville
Hemstreet & Bell	a, b	411 C St., Marysville	
Marysville Sand Co., Inc., C. J. Hoffman, Mgr.	a	Marysville	
Pacific Coast Aggregates, Inc.		85 2d St., San Francisco	Marysville
Pratt Building Material Co., Clarence F. Pratt, Gen. Mgr.*	a	Hearst Bldg., San Francisco	

a. Sand and gravel. b. Crushed rock (macadam, ballast, rubble, riprap, etc.). c. Molding sand. d. Granules for roofing, terrazzo. e. Slag. f. Tube mill pebbles. g. Decomposed granite.
* Consolidated with Pacific Coast Aggregates, Inc., Sept. 1, 1929.

SULPHUR

Operator	Product	Address	Mine
Colusa County			
Elgin Mine, H. C. Warwick, Supt.		3769 Jackson St., San Francisco	Wilbur Springs

TIN

Operator	Product	Address	Mine
Riverside County			
American Tin Corp.		P. O. Box 814, Riverside	Temescal

TUNGSTEN

Operator	Product	Address	Mine
Inyo County			
Round Valley Tungsten Co., Cooper Shapley		Bishop	
Kern County			
Robert Gunderson		Randsburg	Randsburg
San Bernardino County			
Atolia Mining Co., A. V. Udell		1022 Crocker Bldg., San Francisco	Atolia
W. H. Mann Property		Randsburg	Atolia

APPENDIX

MINING BUREAU ACT

Chap. 679 [Stats. 1913]; amended, Chap. 280 [Stats. 1929.]

An act establishing a state mining bureau, creating the office of state mineralogist, fixing his salary and prescribing his powers and duties; providing for the employment of officers and employees of said bureau, making it the duty of persons in charge of mines, mining operations and quarries to make certain reports, providing for the investigation of mining operations, dealings and transactions and the prosecution for defrauding, swindling and cheating therein, creating a state mining bureau fund for the purpose of carrying out the provisions of this act and repealing an act entitled "An act to provide for the establishment, maintenance, and support of a bureau, to be known as the state mining bureau, and for the appointment and duties of a board of trustees, to be known as the board of trustees of the state mining bureau, who shall have the direction, management and control of said state mining bureau, and to provide for the appointment, duties, and compensation of a state mineralogist, who shall perform the duties of his office under the control, direction and supervision of the board of trustees of the state mining bureau," approved March 23, 1893, and all acts amendatory thereof and supplemental thereto or in conflict herewith.

[Approved June 16, 1913. In effect August 10, 1913.]

[Amendment approved May 14, 1929. In effect August 14, 1929.]

The people of the State of California do enact as follows:

SECTION 1. There is hereby created and established a state mining bureau. The chief officer of such bureau shall be the state mineralogist, which office is hereby created.

SEC. 2. It shall be the duty of the governor of the State of California and he is hereby empowered to appoint a citizen and resident of this state, having a practical and scientific knowledge of mining, to the office of state mineralogist. Said state mineralogist shall hold his office at the pleasure of the governor. He shall be a civil executive officer. He shall take and subscribe the same oath of office as other state officers. He shall receive for his services a salary of three hundred dollars ($300) per month, to be paid at the same time and in the same manner as the salaries of other state officers. He shall also receive his necessary traveling expenses when traveling on the business of his office. He shall give bond for the faithful performance of his duties in the sum of ten thousand dollars ($10,000), said bond to be approved by the governor of the state of California.

SEC. 3. Said state mineralogist shall employ competent geologists, field assistants, qualified specialists and office employees when necessary in the execution of his plans and operations of the bureau, and fix their compensation. The said employees shall be allowed their necessary traveling expenses when traveling on the business of said department and shall hold office at the pleasure of said state mineralogist.

SEC. 4. It shall be the duty of said state mineralogist to make, facilitate, and encourage, special studies of the mineral resources and mineral industries of the state. It shall be his duty: to collect statistics concerning the occurrence and production of the economically important minerals and the methods pursued in making their valuable constituents available for commercial use; to make a collection of typical geological and mineralogical specimens, especially those of economic and commercial importance, such collection constituting the museum of the state mining bureau; to provide a library of books, reports, drawings, bearing upon the mineral industries, and sciences of mineralogy and geology, and arts of mining and metallurgy, such library constituting the library of the state mining bureau; to make a collection of models, drawings and descriptions of the mechanical appliances used in mining and metallurgical processes; to preserve and so maintain such collections and library as to make them available for reference and examination, and open to public inspection at reasonable hours; to maintain, in effect, a bureau of information

concerning the mineral industries of this state, to consist of such collections and library, and to arrange, classify, catalogue, and index the data therein contained, in a manner to make the information availble to those desiring it; to issue from time to time such bulletins as he may deem advisable concerning the statistics and technology of the mineral industries of this state.

SEC. 5. It is hereby made the duty of the owner, lessor, lessee, agent, manager or other person in charge of each and every mine, of whatever kind or character, within the state, to forward to the state mineralogist, upon his request, at his office not later than the thirty-first day of March, in each year, a detailed report upon forms which will be furnished showing the character of the mine, the number of men then employed, the method of working such mine and the general condition thereof, the total mineral production for the past year, and such owner, lessor, lessee, agent, manager or other person in charge of any mine within the state must furnish whatever information relative to such mine as the state mineralogist may from time to time require for the proper discharge of his official duties. Any owner, lessor, lessee, agent, manager or other person in charge of each and every mine of whatever kind or character within the state, who fails to comply with the above provisions shall be deemed guilty of a misdemeanor.*

SEC. 6. The state mineralogist now performing the duties of the office of state mineralogist shall perform the duties of the office of state mineralogist as in this act provided until the appointment and qualification of his successor as in this act provided.

SEC. 7. The said state mineralogist shall take possession, charge and control of the offices now occupied and used by the board of trustees and state mineralogist and the museum, library and laboratory of the mining bureau located in San Francisco as provided for by a certain act of the legislature approved March 23, 1893, and hereafter referred to in section fourteen hereof, and shall maintain such offices, museum, library and laboratory for the purposes provided in this act.

SEC. 8. Said state mineralogist or qualified assistant shall have full power and authority at any time to enter or examine any and all mines, quarries, wells, mills, reduction works, refining works and other mineral properties or working plants in this state in order to gather data to comply with the provisions of this act.

SEC. 9. The state mineralogist shall make a biennial report to the governor on or before the fifteenth day of September next preceding the regular session of the legislature.

SEC. 10. All moneys received by the state mining bureau or any officer thereof (except such as may be paid to them by the state for disbursement) shall be receipted for by the state mineralogist or other officer authorized by him to act in his place and at least once a month accounted for by him to the state controller and paid into the state treasury to the credit of a fund which is hereby created and designated "state mining bureau fund." All moneys now in the possession of the state mining bureau or any officer thereof received from any source whatsoever, shall be immediately paid over to the state mineralogist and by him accounted for to the controller and paid into the state treasury to the credit of said fund. Said fund shall be used and is hereby appropriated for the use of said bureau in carrying out the purposes of this act.

SEC. 11. The said state mineralogist is hereby authorized and empowered to receive on behalf of this state, for the use and benefit of the state mining bureau, gifts, bequests, devises and legacies of real or other property and to use the same in accordance with the wishes of the donors, and if no instructions are given by said donors, to manage, use, and dispose of the gifts and bequests and legacies for the best interests of said state mining bureau and in such manner as he may deem proper.

SEC. 12. The state mineralogist may, whenever he deems it advisable, prepare a special collection of ores and minerals of California to be sent to or used at any world's fair or exposition in order to display the mineral wealth of the state.

SEC. 13. The state minerologist is hereby empowered to fix a price upon and to dispose of to the public, at such price, any and all publications of the state mining bureau, including reports, bulletins, maps, registers or other publications, such price shall approximate the cost of publication and distribution. Any and all sums derived from such disposition, or from gifts or bequests made, as hereinbefore provided must be accounted for by said state mineralogist and turned over to the

* Sec. 19 of the Penal Code of California provides: "Except in cases where a different punishment is prescribed by this code, every offense declared to be a misdemeanor is punishable by imprisonment in a county jail not exceeding six months, or by a fine not exceeding five hundred dollars, or by both."

state treasurer to be credited to the mining bureau fund as provided for in section ten. He is also empowered to furnish without cost to public libraries the publications of the bureau and to exchange publications with other geological surveys and scientific societies, etc.

SEC. 14. The state mineralogist provided for by this act shall be the successor in interest of the board of trustees of the state mining bureau, and the state mineralogist, under and by virtue of that certain act, entitled "An act to provide for the establishment, maintenance, and support of a bureau, to be known as the state mining bureau, and for the appointment and duties of a board of trustees, to to be known as the board of trustees of the state mining bureau, who shall have the direction, management, and control of said state mining bureau, and to provide for the appointment, duties, and compensation of a state mineralogist, who shall perform the duties of his office under the control, direction and supervision of the board of trustees of the state mining bureau," approved March 23, 1893, and all books, papers, documents, personal property, records, and property of every kind and description obtained or possessed, or held or controlled by the said board of trustees of the said state mining bureau, and the state mineralogist, and the clerks and employees thereof, under the provisions of said act of March 23, 1893, or any act supplemental thereto or amendatory thereof, shall immediately be turned over and delivered to the said state mineralogist herein provided for, who shall have charge and control thereof.

SEC. 15. That certain act entitled "An act to provide for the establishment, maintenance, and support of a bureau, to be known as the state mining bureau, and for the appointment and duties of a board of trustees, to be known as the board of trustees of the state mining bureau, and to provide for the appointment, duties and compensation of a state mineralogist, who shall perform the duties of his office under the control, direction, and supervision of the board of trustees of the state mining bureau," approved March 23, 1893, together with all acts amendatory thereof and supplemental thereto and all acts in conflict herewith are hereby repealed.

SEC. 16. For the purpose of this act and as used herein the term "mine" is hereby defined to embrace and include all mineral bearing properties of whatever kind or character whether underground, quarry, pit, well, spring or other source from which any mineral substance is or may be obtained, and the term "mineral" for the purposes of this act and whenever so used shall embrace and include any and all mineral products both metallic and nonmetallic, solid, liquid or gaseous, and mineral waters of whatever kind or character.

DEPARTMENT OF NATURAL RESOURCES ACT

Chap. 128 [Stats. 1927]; amended, Chap. 307 [Stats. 1929.]

An act to add a new article to chapter three of title one of part three of the Political Code to be numbered article two j, embracing sections three hundred seventy-three to three hundred seventy-three i, relating to a department of natural resources.

[Approved by the Governor April 13, 1927.]

[Amendment approved May 18, 1929.]

The people of the State of California do enact as follows:

SECTION 1. The Political Code is hereby amended by adding a new article to chapter III of title I of part III thereof, to be numbered article II*j*, embracing sections 373 to 373*i* and to read as follows:

ARTICLE II*j*.

DEPARTMENT OF NATURAL RESOURCES.

373. A department of the government of the State of California to be known as the department of natural resources is hereby created. The department shall be conducted under the control of an executive officer to be known as the director of natural resources, which office is hereby created. The director shall be appointed by and hold office at the pleasure of the governor and shall receive a salary of six thousand dollars per annum.

Except as in this article otherwise provided, the provisions of article II of this chapter, title, and part of the Political Code as adopted at the forty-fourth session of the Legislature and as the same may be amended from time to time, shall govern and apply to the conduct of the department of natural resources in every respect the same as if such provisions were herein set forth at length and wherever in said article II the term "head of the department" or similar designation occurs, the same shall for the purposes of this article mean the director of natural resources.

373*a*. For purposes of administration the department shall be forthwith organized by the director thereof, subject to the approval of the governor, in such manner as he shall deem necessary to properly segregate and conduct the work of the department, and the director shall have power to appoint, in accordance with the civil service and other provisions of law, such deputies, officers and other expert and clerical assistants as may be necessary. The work of the department is hereby divided into at least four divisions to be known as the division of forestry, the division of parks, the division of fish and game, and the division of mines.

373*b*. The division of mines shall be administered through a chief who shall be appointed by the director of natural resources upon the nomination of the state mining board, the chief to be a technically trained mining engineer and to be known as the state mineralogist; such chief shall receive a salary of six thousand dollars per annum. General policies for the guidance of the division of mines shall be determined by a board to be known as the state mining board, which shall consist of five members appointed by and to hold office at the pleasure of the governor.

373*c*. The division of forestry shall be administered through a chief of division who shall be known as the state forester, who shall be a technically trained forester, appointed by the director of natural resources upon nomination by the state board of forestry hereinafter provided. General policies for the guidance of the division of forestry shall be determined by a state board of forestry which shall consist of seven members appointed by and holding office at the pleasure of the governor. Of the seven members one shall be familiar with the pine timber industry, one with the redwood industry, one with the live stock industry, one with general agriculture and one with the problems of water conservation.

373*d*. The division of parks shall be administered through a chief of division who shall be appointed by the director of natural resources upon nomination by the state park commission hereinafter provided. General policies for the administration of the state park system shall be determined by the state park commission

which is hereby created to consist of five members appointed by the governor and holding office at his pleasure.

373*e*. The division of fish and game shall be administered through a fish and game commission consisting of three members appointed by and holding office at the pleasure of the governor.

373*f*. The chiefs of the divisions of forestry and parks respectively shall receive such salaries as may be determined by the director with the approval of the governor. The director of natural resources and the chief of each devision before entering upon his duties shall execute to the State of California an official bond in the penal sum of twenty-five thousand dollars conditioned upon the faithful performance of his duties. The members of the board of forestry, the state parks commission and fish and game commission shall serve without compensation, but shall be entitled to their actual expenses incurred in the performance of their duties.

373*g*. The department of natural resources shall succeed to and is hereby invested with all the duties, powers, purposes, responsibilities and jurisdiction of the state mining bureau, state mineralogist, department of petroleum and gas, state oil and gas supervisor, state forester, state board of forestry, California redwood park commission, San Pasqual battlefield commission, Mount Diablo park commission, state fish and game commission, state fish and game commissioners, and, except as herein otherwisee provided, of the several officers, deputies and employees of such bodies and offices, and whenever by the provisions of any statute or law now in force or that may hereafter be enacted a duty or jurisdiction is imposed or authority conferred upon any of said officers, offices, bodies, deputies or employees by any statute the enforcement of which is transferred to the department, such duty, jurisdiction and authority are hereby imposed upon and transferred to the department of natural resources and the appropriate officers thereof with the same force and effect as though the title of said department of natural resources had been specifically set forth and named therein in lieu of the name of any such body, office, officer, deputy or employee. Said bodies and offices, the duties, powers, purposes, responsibilities and jurisdiction of which are so transferred and vested in the department of natural resources, and the positions of all officers, deputies and employees thereunder, are and each of them is hereby abolished and shall have no further legal existence, but the statutes and laws under which they existed and all laws prescribing their duties, powers, purposes, responsibilities and jurisdiction, together with all lawful rules and regulations established thereunder are hereby expressly continued in force.

The department of natural resources shall be in possession and control of all records, books, papers, offices, equipment, supplies, moneys, funds, appropriations, land and other property real or personal now or hereafter held for the benefit or use of said bodies, offices and officers.

The boards of district oil and gas commissioners, the offices of district oil and gas commissioners and the board of review, correction and equalization created by the act approved June 10, 1915, establishing the department of petroleum and gas, are hereby respectively continued in force wiith the powers, duties, responsibilities and jurisdiction in them vested by the provisions of said act approved June 10, 1915, as amended; *provided*, that said board of review shall consist of the director of natural resources, the director of finance and the chairman of the state board of equalization.

373*h*. The management and control of the property acquired by the State of California under or pursuant to the provisions of the act entitled "An act to accept the gift to the state of San Pasqual battlefield in San Diego county, to provide for collecting and systematizing the history of said battle, for determining the exact location thereof, and to report a suitable method of marking said battlefield and commemorating the heroism of those Americans who fought and died there," approved May 11, 1919, is hereby transferred to and vested in the department of natural resources.

373*i*. From and after the date upon which this act takes effect, the department of natural resources shall be and is hereby authorized and empowered to expend the moneys in any appropriation or in any special fund in the state treasury now remaining or made available by law for the administration of the provisions of all the statutes the administration of which is committed to the department, or for the use, support, or maintenance of any board, bureau, commission, department, office or officer whose duties, powers, and functions are, by the provisions of this article, transferred to and conferred upon the department of natural resources. Such expenditures by the department shall be made in accordance with law in carrying out the purposes for which such appropriations were made or such special funds created.

PUBLICATIONS OF THE DIVISION OF MINES

During the past fifty years, in carrying out the provisions of the organic act creating the former California State Mining Bureau, there have been published many reports, bulletins and maps which go to make up a library of detailed information on the mineral industry of the state, a large part of which could not be duplicated from any other source.

One feature that has added to the popularity of the publications is that many of them have been distributed without cost to the public, and even the more elaborate ones have been sold at a price which barely covers the cost of printing.

Owing to the fact that funds for the advancing of the work of this department have often been limited, many of the reports and bulletins mentioned were printed in limited editions which are now entirely exhausted.

Copies of such publications are available, however, in the office of the Division of Mines, in the Ferry Building, San Francisco; New Orpheum Building, Los Angeles; State Office Building, Sacramento; Redding; Santa Barbara; Santa Paula; Coalinga; Taft; Bakersfield. They may also be found in many public, private and technical libraries in California and other states, and foreign countries.

A catalog of all publications from 1880 to 1917, giving a synopsis of their contents, is issued as Bulletin No. 77.

Publications in stock may be obtained by addressing any of the above offices and enclosing the requisite amount in the case of publications that have a list price. Only coin, stamps or money orders should be sent, and it will be appreciated if remittance is made in this manner rather than by personal check.

The prices noted include delivery charges to all parts of the United States. Money orders should be made payable to the Division of Mines.

NOTE.—The Division of Mines frequently receives requests for some of the early reports and bulletins now out of print, and it will be appreciated if parties having such publications and wishing to dispose of them will advise this office.

REPORTS

Asterisks (**) indicate the publication is out of print.

	Price
**First Annual Report of the State Mineralogist, 1880, 43 pp. Henry G. Hanks	----
**Second Annual Report of the State Mineralogist, 1882, 514 pp., 4 illustrations, 1 map. Henry G. Hanks	----
**Third Annual Report of the State Mineralogist, 1883, 111 pp., 21 illustrations. Henry G. Hanks	----
**Fourth Annual Report of the State Mineralogist, 1884, 410 pp., 7 illustrations. Henry G. Hanks	----
**Fifth Annual Report of the State Mineralogist, 1885, 234 pp., 15 illustrations, 1 geological map. Henry G. Hanks	----
**Sixth Annual Report of the State Mineralogist, Part I, 1886, 145 pp., 3 illustrations, 1 map. Henry G. Hanks	----
**Part II, 1887, 222 pp., 36 illustrations. William Irelan, Jr.	----
**Seventh Annual Report of the State Mineralogist, 1887, 315 pp. William Irelan, Jr.	----
**Eighth Annual Report of the State Mineralogist, 1888, 948 pp., 122 illustrations. William Irelan, Jr.	----
**Ninth Annual Report of the State Mineralogist, 1889, 352 pp., 57 illustrations, 2 maps. William Irelan, Jr.	----

REPORTS—Continued

Asterisks (**) indicate the publication is out of print.

	Price
**Tenth Annual Report of the State Mineralogist, 1890, 983 pp., 179 illustrations, 10 maps. William Irelan, Jr.	----
Eleventh Report (First Biennial) of the State Mineralogist, for the two years ending September 15, 1892, 612 pp., 73 illustrations, 4 maps. William Irelan, Jr.	$1.00
**Twelfth Report (Second Biennial) of the State Mineralogist, for the two years ending September 15, 1894, 541 pp., 101 illustrations, 5 maps. J. J. Crawford	----
**Thirteenth Report (Third Biennial) of the State Mineralogist, for the two years ending September 15, 1896, 726 pp., 93 illustrations, 1 map. J. J. Crawford	----
Chapters of the State Mineralogist's Report, Biennial Period, 1913–1914, Fletcher Hamilton:	
**Mines and Mineral Resources, Amador, Calaveras and Tuolumne Counties, 172 pp., paper	----
Mines and Mineral Resources, Colusa, Glenn, Lake, Marin, Napa, Solano, Sonoma and Yolo Counties, 208 pp., paper	.50
**Mines and Mineral Resources, Del Norte, Humboldt and Mendocino Counties, 59 pp., paper	----
**Mines and Mineral Resources, Fresno, Kern, Kings, Madera, Mariposa, Merced, San Joaquin and Stanislaus Counties, 220 pages, paper	----
**Mines and Mineral Resources of Imperial and San Diego Counties, 113 pp., paper	----
**Mines and Mineral Resources, Shasta, Siskiyou and Trinity Counties, 180 pp., paper	----
**Fourteenth Report of the State Mineralogist, for the Biennial Period 1913–1914, Fletcher Hamilton, 1915: A General Report on the Mines and Mineral Resources of Amador, Calaveras, Tuolumne, Colusa, Glenn, Lake, Marin, Napa, Solano, Sonoma, Yolo, Del Norte, Humboldt, Mendocino, Fresno, Kern, Kings, Madera, Mariposa, Merced, San Joaquin, Stanislaus, San Diego, Imperial, Shasta, Siskiyou and Trinity Counties, 974 pp., 275 illustrations, cloth	----
Chapters of the State Mineralogist's Report, Biennial Period, 1915–1916. Fletcher Hamilton:	
**Mines and Mineral Resources, Alpine, Inyo and Mono Counties, 176 pp., paper	----
Mines and Mineral Resources, Butte, Lassen, Modoc, Sutter and Tehama Counties, 91 pp., paper	.50
Mines and Mineral Resources, El Dorado, Placer, Sacramento and Yuba Counties, 198 pp., paper	.65
Mines and Mineral Resources, Monterey, San Benito, San Luis Obispo, Santa Barbara and Ventura Counties, 183 pp., paper	.65
**Mines and Mineral Resources, Los Angeles, Orange and Riverside Counties, 136 pp., paper	----
**Mines and Mineral Resources, San Bernardino and Tulare Counties, 186 pp., paper	----
**Fifteenth Report of the State Mineralogist, for the Biennial Period 1915–1916, Fletcher Hamilton. 1917: A General Report on the Mines and Mineral Resources of Alpine, Inyo, Mono, Butte, Lassen, Modoc, Sutter, Tehama, Placer, Sacramento, Yuba, Los Angeles, Orange, Riverside, San Benito, San Luis Obispo, Santa Barbara, Ventura, San Bernardino and Tulare Counties, 990 pp., 413 illustrations. cloth	----
Chapters of the State Mineralogist's Report, Biennial Period 1917–1918, Fletcher Hamilton:	
Mines and Mineral Resources of Nevada County, 270 pp., paper	.75
Mines and Mineral Resources of Plumas County, 188 pp., paper	.50
Mines and Mineral Resources of Sierra County. 144 pp., paper	.50
Seventeenth Report of the State Mineralogist, 1920. 'Mining in California during 1920,' Fletcher Hamilton; 562 pp., 71 illustrations, cloth	1.75
Eighteenth Report of the State Mineralogist. 1922. 'Mining in California,' Fletcher Hamilton. Chapters published monthly beginning with January, 1922:	
**January, **February, **March, **April, **May, **June, July, August, **September, October, November, December, 1922	Free
Chapters of Nineteenth Report of the State Mineralogist, 'Mining in California,' Fletcher Hamilton and Lloyd L. Root. January, February, March, September, 1923	Free
Chapters of Twentieth Report of the State Mineralogist, 'Mining in California,' Lloyd L. Root. Published quarterly. January, April, **July, October, 1924, per copy	.25

REPORTS—Continued

Asterisks (**) indicate the publication is out of print.

	Price
Chapters of Twenty-first Report of the State Mineralogist, 'Mining in California,' Lloyd L. Root. Published quarterly:	
January, 1925, Mines and Mineral Resources of Sacramento, Monterey and Orange Counties	$0.25
April, 1925, Mines and Mineral Resources of Calaveras, Merced, San Joaquin, Stanislaus and Ventura Counties	.25
July, 1925, Mines and Mineral Resources of Del Norte, Humboldt and San Diego Counties	.25
October, 1925, Mines and Mineral Resources of Siskiyou, San Luis Obispo and Santa Barbara Counties	.25
Subscription, $1.00 in advance (by calendar year, only).	
Chapters of Twenty-second Report of the State Mineralogist, 'Mining in California,' Lloyd L. Root. Published quarterly:	
January, 1926, Mines and Mineral Resources of Trinity and Santa Cruz Counties	.25
April, 1926, Mines and Mineral Resources of Shasta, San Benito and Imperial Counties	.25
July, 1926, Mines and Mineral Resources of Marin and Sonoma Counties	.25
October, 1926, Mines and Mineral Resources of El Dorado and Inyo Counties, also report on Minaret District, Madera County	.25
Chapters of Twenty-third Report of the State Mineralogist, 'Mining in California,' Lloyd L. Root. Published quarterly:	
January, 1927, Mines and Mineral Resources of Contra Costa County; Santa Catalina Island	.25
April, 1927, Mines and Mineral Resources of Amador and Solano Counties	.25
July, 1927, Mines and Mineral Resources of Placer and Los Angeles Counties	.25
October, 1927, Mines and Mineral Resources of Mono County	.25
Chapters of Twenty-fourth Report of the State Mineralogist, 'Mining in California,' Lloyd L. Root. Published quarterly:	
January, 1928, Mines and Mineral Resources of Tuolumne County	.25
April, 1928, Mines and Mineral Resources of Mariposa County	.25
**July, 1928, Mines and Mineral Resources of Butte and Tehama Counties	----
October, 1928, Mines and Mineral Resources of Plumas and Madera Counties	.25
Chapters of Twenty-fifth Report of the State Mineralogist, 'Mining in California,' Walter W. Bradley. Published quarterly:	
January, 1929, Mines and Mineral Resources of Lassen, Modoc and Kern Counties; also on Special Placer Machines	.25
April, 1929, Mines and Mineral Resources of Sierra, Napa, San Francisco and San Mateo Counties	.25
July, 1929, Mines and Mineral Resources of Colusa, Fresno and Lake Counties	.25
October, 1929, Mines and Mineral Resources of Glenn, Alameda, Mendocino and Riverside Counties	.25
Chapters of Twenty-sixth Report of the State Mineralogist 'Mining in California,' Walter W. Bradley. Published quarterly:	
January, 1930, Mines and Mineral Resources of Santa Clara County; also Barite in California	.25
Chapters of State Oil and Gas Supervisor's Report:	
Summary of Operations—California Oil Fields, July, 1918, to March, 1919 (one volume)	Free
Summary of Operations—California Oil Fields. Published monthly, beginning April, 1919:	
**April, **May, June, **July, **August, **September, **October, November, **December, 1919	Free
January, February, March, April, **May, June, July, **August, September, October, November, December, 1920	Free
January, **February, **March, **April, May, June, **July, August, **September, **October, **November, **December, 1921	Free
January, February, March, April, May, June, July, August, September, October, November, December, 1922	Free
January, February, March, April, May, June, July, August, September, October, November, December, 1923	Free
January, February, March, April, May, June, July, August, September, October, November, December, 1924	Free
January, February, March, April, May, June, July, August, September, October, November, December, 1925	Free
January, February, March, April, May, June, July, August, September, October, November, December, 1926	Free
January, February, March, April, May, June, July, August, September, October, November, December, 1927	Free
January, February, March, April, May, June, July, 1928	Free

BULLETINS

Asterisks (**) indicate the publication is out of print.

	Price
**Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrations	----
**Bulletin No. 2. Methods of Mine Timbering, by W. H. Storms. 1894, 58 pp., 75 illustrations	----
**Bulletin No. 3. Gas and Petroleum Yielding Formations of Central Valley of California, by W. L. Watts. 1894, 100 pp., 13 illustrations, 4 maps	----
**Bulletin No. 4. Catalogue of Californian Fossils, by J. G. Cooper, 1894, 73 pp., 67 illustrations. (Part I was published in the Seventh Annual Report of the State Mineralogist, 1887.)	----
**Bulletin No. 5. The Cyanide Process, 1894, by Dr. A. Scheidel. 140 pp., 46 illustrations	----
**Bulletin No. 6. California Gold Mill Practices, 1895, by E. B. Preston, 85 pp., 46 illustrations	----
**Bulletin No. 7. Mineral Production of California, by Counties, for the year 1894, by Charles G. Yale. Tabulated sheet	----
**Bulletin No. 8. Mineral Production of California, by Counties, for the year 1895, by Charles G. Yale. Tabulated sheet	----
**Bulletin No. 9. Mine Drainage, Pumps, etc., by Hans C. Behr. 1896, 210 pp., 206 illustrations	----
**Bulletin No. 10. A bibliography Relating to the Geology, Palæontology and Mineral Resources of California, by Anthony W. Vogdes. 1896, 121 pp.	----
**Bulletin No. 11. Oil and Gas Yielding Formations of Los Angeles, Ventura and Santa Barbara Counties, by W. L. Watts. 1897, 94 pp., 6 maps, 31 illustrations	----
**Bulletin No. 12. Mineral Production of California, by Counties, for 1896, by Charles G. Yale. Tabulated sheet	----
**Bulletin No. 13. Mineral Production of California, by Counties, for 1897, by Charles G. Yale. Tabulated sheet	----
**Bulletin No. 14. Mineral Production of California, by Counties, for 1898, by Charles G. Yale	----
**Bulletin No. 15. Map of Oil City Fields, Fresno County, by John H. Means. 1899	----
**Bulletin No. 16. The Genesis of Petroleum and Asphaltum in California, by A. S. Cooper. 1899, 39 pp., 29 illustrations	----
**Bulletin No. 17. Mineral Production of California, by Counties, for 1899, by Charles G. Yale. Tabulated sheet	----
**Bulletin No. 18. Mother Lode Region of California, by W. H. Storms. 1900, 154 pp., 49 illustrations	----
**Bulletin No. 19. Oil and Gas Yielding Formations of California, by W. L. Watts. 1900, 236 pp., 60 illustrations, 8 maps	----
**Bulletin No. 20. Synopsis of General Report of State Mining Bureau, by W. L. Watts. 1901, 21 pp. This bulletin contains a brief statement of the progress of the mineral industry in California for the four years ending December, 1899	----
**Bulletin No. 21. Mineral Production of California by Counties, by Charles G. Yale. 1900. Tabulated sheet	----
**Bulletin No. 22. Mineral Production of California for Fourteen Years, by Charles G. Yale. 1900. Tabulated sheet	----
Bulletin No. 23. The Copper Resources of California, by P. C. DuBois, F. M. Anderson, J. H. Tibbits and G. A. Tweedy. 1902, 282 pp., 69 illustrations, 9 maps	$0.50
**Bulletin No. 24. The Saline Deposits of California, by G. E. Bailey. 1902, 216 pp., 99 illustrations, 5 maps	----
**Bulletin No. 25. Mineral Production of California, by Counties, for 1901, by Charles G. Yale. Tabulated sheet	----
**Bulletin No. 26. Mineral Production of California for the Past Fifteen Years, by Charles G. Yale. 1902. Tabulated sheet	----
**Bulletin No. 27. The Quicksilver Resources of California, by William Forstner. 1903, 273 pp., 144 illustrations, 8 maps	----
**Bulletin No. 28. Mineral Production of California for 1902, by Charles G. Yale. Tabulated sheet	----
**Bulletin No. 29. Mineral Production of California for Sixteen Years, by Charles G. Yale. 1903. Tabulated sheet	----
**Bulletin No. 30. Bibliography Relating to the Geology, Palæontology and Mineral Resources of California, by A. W. Vogdes. 1903, 290 pp.	----
**Bulletin No. 31. Chemical Analyses of California Petroleum, by H. N. Cooper. 1904. Tabulated sheet	----
**Bulletin No. 32. Production and Use of Petroleum in California, by Paul W. Prutzman. 1904, 230 pp., 116 illustrations, 14 maps	----

BULLETINS—Continued

Asterisks (**) indicate the publication is out of print.

Price

**Bulletin No. 33. Mineral Production of California, by Counties, for 1903, by Charles G. Yale. Tabulated sheet ----
**Bulletin No. 34. Mineral Production of California for Seventeen Years, by Charles G. Yale. 1904. Tabulated sheet ----
**Bulletin No. 35. Mines and Minerals of California, by Charles G. Yale. 1904, 55 pp., 20 county maps. Relief map of California ----
**Bulletin No. 36. Gold Dredging in California, by J. E. Doolittle. 1905. 120 pp., 66 illustrations, 3 maps ----
**Bulletin No. 37. Gems, Jewelers' Materials, and Ornamental Stones of California, by George F. Kunz. 1905, 168 pp., 54 illustrations ----
**Bulletin No. 38. Structural and Industrial Materials of California, by Wm. Forstner, T. C. Hopkins, C. Naramore and L. H. Eddy. 1906, 412 pp., 150 illustrations, 1 map ----
**Bulletin No. 39. Mineral Production of California, by Counties, for 1904, by Charles G. Yale. Tabulated sheet ----
**Bulletin No. 40. Mineral Production of California for Eighteen Years, by Charles G. Yale. 1905. Tabulated sheet ----
**Bulletin No. 41. Mines and Minerals of California for 1904, by Charles G. Yale. 1905, 54 pp., 20 county maps ----
**Bulletin No. 42. Mineral Production of California, by Counties, 1905, by Charles G. Yale. Tabulated sheet ----
**Bulletin No. 43. Mineral Production of California for Nineteen Years, by Charles G. Yale. Tabulated sheet ----
**Bulletin No. 44. California Mines and Minerals for 1905, by Charles G. Yale. 1907, 31 pp., 20 county maps ----
**Bulletin No. 45. Auriferous Black Sands of California, by J. A. Edman. 1907. 10 pp. ----
**Bulletin No. 46. General Index of Publications of the California State Mining Bureau, by Charles G. Yale. 1907, 54 pp. ----
**Bulletin No. 47. Mineral Production of California, by Counties, 1906, by Charles G. Yale. Tabulated sheet ----
**Bulletin No. 48. Mineral Production of California for Twenty Years, by Charles G. Yale. 1906 ----
**Bulletin No. 49. Mines and Minerals of California for 1906, by Charles G. Yale. 34 pp. ----
Bulletin No. 50. The Copper Resources of California, 1908, by A. Hausmann, J. Kruttschnitt, Jr., W. E. Thorne and J. A. Edman. 366 pp., 74 illustrations. (Revised edition.) $1.00
**Bulletin No. 51. Mineral Production of California, by Counties, 1907, by D. H. Walker. Tabulated sheet ----
**Bulletin No. 52. Mineral Production of California for Twenty-one Years, by D. H. Walker. 1907. Tabulated sheet ----
**Bulletin No. 53. Mineral Production of California for 1907, with County Maps, by D. H. Walker. 62 pp. ----
**Bulletin No. 54. Mineral Production of California, by Counties, by D. H. Walker, 1908. Tabulated sheet ----
**Bulletin No. 55. Mineral Production of California for Twenty-two Years, by D. H. Walker, 1908. Tabulated sheet ----
**Bulletin No. 56. Mineral Production for 1908, with County Maps and Mining Laws of California, by D. H. Walker. 78 pp. ----
**Bulletin No. 57. Gold Dredging in California, by W. B. Winston and Chas. Janin. 1910, 312 pp., 239 illustrations, 10 maps ----
**Bulletin No. 58. Mineral Production of California, by Counties, by D. H. Walker. 1909. Tabulated sheet ----
**Bulletin No. 59. Mineral Production of California for Twenty-three Years, by D. H. Walker. 1909. Tabulated sheet ----
**Bulletin No. 60. Mineral Production for 1909, with County Maps and Mining Laws of California, by D. H. Walker. 94 pp. ----
**Bulletin No. 61. Mineral Production of California, by Counties, for 1910, by D. H. Walker. Tabulated sheet ----
**Bulletin No. 62. Mineral Production of California for Twenty-four Years, by D. H. Walker. 1910. Tabulated sheet ----
**Bulletin No. 63. Petroleum in Southern California, by P. W. Prutzman. 1912, 430 pp., 41 illustrations, 6 maps ----
**Bulletin No. 64. Mineral Production for 1911, by E. S. Boalich. 49 pp. ----
**Bulletin No. 65. Mineral Production for 1912, by E. S. Boalich. 64 pp. ----
**Bulletin No. 66. Mining Laws of the United States and California. 1914, 89 pp. ----
**Bulletin No. 67. Minerals of California, by Arthur S. Eakle. 1914, 226 pp. ----

BULLETINS—Continued

Asterisks (**) indicate the publication is out of print.

	Price
**Bulletin No. 68. Mineral Production for 1913, with County Maps and Mining Laws, by E. S. Boalich. 160 pp.	----
**Bulletin No. 69. Petroleum Industry of California, with Folio of Maps (18 by 22), by R. P. McLaughlin and C. A. Waring. 1914, 519 pp., 13 illustrations, 83 figs. [18 plates in accompanying folio.]	----
**Bulletin No. 70. Mineral Production for 1914, with County Maps and Mining Laws. 184 pp.	----
**Bulletin No. 71. Mineral Production for 1915, with County Maps and Mining Laws, by Walter W. Bradley. 193 pp., 4 illustrations	----
**Bulletin No. 72. The Geologic Formations of California, by James Perrin Smith. 1916, 47 pp.	----
**Reconnaissance Geologic Map (of which Bulletin 72 is explanatory), in 23 colors. Scale: 1 inch = 12 miles. Mounted	----
**Bulletin No. 73. First Annual Report of the State Oil and Gas Supervisor of California, for the Fiscal Year 1915–16, by R. P. McLaughlin. 278 pp., 26 illustrations	----
**Bulletin No. 74. Mineral Production of California in 1916, with County Maps, by Walter W. Bradley. 179 pp., 12 illustrations	----
**Bulletin No. 75. United States and California Mining Laws. 1917, 115 pp., paper	----
Bulletin No. 76. Manganese and Chromium in California, by Walter W. Bradley, Emile Huguenin, C. A. Logan, W. B. Tucker and C. A. Waring. 1918, 248 pp., 51 illustrations, 5 maps, paper	$0.50
Bulletin No. 77. Catalogue of Publications of California State Mining Bureau, 1880–1917, by E. S. Boalich. 44 pp., paper	Free
Bulletin No. 78. Quicksilver Resources of California, with a Section on Metallurgy and Ore-Dressing, by Walter W. Bradley. 1919, 389 pp., 77 photographs and 42 plates (colored and line cuts), cloth	1.50
Bulletin No. 79. Magnesite in California, by Walter W. Bradley. 1925, 147 pp., 62 photographs, 11 line cuts and maps, cloth	1.00
†Bulletin No. 80. Tungsten, Molybdenum and Vanadium in California. (In preparation.)	
†Bulletin No. 81. Foothill Copper Belt of California. (In preparation.)	
**Bulletin No. 82. Second Annual Report of the State Oil and Gas Supervisor, for the Fiscal Year 1916-1917, by R. P. McLaughlin. 1918, 412 pp., 31 illustrations, cloth	----
Bulletin No. 83. California Mineral Production for 1917, with County Maps, by Walter W. Bradley. 179 pp., paper	Free
**Bulletin No. 84. Third Annual Report of the State Oil and Gas Supervisor, for the Fiscal Year 1917–1918, by R. P. McLaughlin. 1918, 617 pp., 28 illustrations, cloth	----
**Bulletin No. 85. Platinum and Allied Metals in California, by C. A. Logan, 1919. 10 photographs, 4 plates, 120 pp., paper	----
Bulletin No. 86. California Mineral Production for 1918, with County Maps, by Walter W. Bradley. 1919, 212 pp., paper	Free
**Bulletin No. 87. Commercial Minerals of California, with notes on their uses, distribution, properties, ores, field tests, and preparation for market, by W. O. Castello. 1920, 124 pp., paper	----
Bulletin No. 88. California Mineral Production for 1919, with County Maps, by Walter W. Bradley. 1920, 204 pp., paper	Free
**Bulletin No. 89. Petroleum Resources of California, with Special Reference to Unproved Areas, by Lawrence Vander Leck. 1921, 12 figures, 6 photographs, 6 maps in pocket, 186 pp., cloth	----
Bulletin No. 90. California Mineral Production for 1920, with County Maps, by Walter W. Bradley. 1921, 218 pp., paper	Free
Bulletin No. 91. Minerals of California, by Arthur S. Eakle. 1923, 328 pp., cloth	1.00
Bulletin No. 92. Gold Placers of California, by Chas. S. Haley. 1923, 167 pp., 36 photographs and 7 plates (colored and line cuts, also geologic map), cloth	1.50
Extra copies of the Geologic Map (in 4 colors)	.50
Bulletin No. 93. California Mineral Production for 1922, by Walter W. Bradley. 1923, 188 pp., paper	Free
Bulletin No. 94. California Mineral Production for 1923, by Walter W. Bradley. 1924, 162 pp., paper	Free
Bulletin No. 95. Geology and Ore Deposits of the Randsburg Quadrangle, by Carlton D. Hulin. 1925, 152 pp., 49 photographs, 13 line cuts, 1 colored geologic map, cloth	2.00
**Bulletin No. 96. California Mineral Production for 1924, by Walter W. Bradley. 1925, 173 pp., paper	----

† Not yet published.

BULLETINS—Continued

Asterisks (**) indicate the publication is out of print.

	Price
**Bulletin No. 97. California Mineral Production for 1925, by Walter W. Bradley. 1926, 172 pp., paper	----
Bulletin No. 98. Mining Law (in press)	----
Bulletin No. 99. Clay Resources and Ceramic Industry of California, by Waldemar Fenn Dietrich. 1928, 383 pp., 70 photos, 12 line cuts including maps, cloth	$1.50
**Bulletin No. 100. California Mineral Production for 1926, by Walter W. Bradley. 1927, 174 pp., paper	----
**Bulletin No. 101. California Mineral Production for 1927, by Henry H. Symons. 1928, 311 pp., paper	----
Bulletin No. 102. California Mineral Production for 1928, by Henry H. Symons. 1929, 210 pp., paper	Free

PRELIMINARY REPORTS

**Preliminary Report No. 1. Notes on Damage by Water in California Oil Fields, December, 1913. By R. P. McLaughlin. 4 pp.	----
**Preliminary Report No. 2. Notes on Damage by Water in California Oil Fields, March, 1914. By R. P. McLaughlin. 4 pp.	----
Preliminary Report No. 3. Manganese and Chromium, 1917. By E. S. Boalich. 32 pp.	Free
**Preliminary Report No. 4. Tungsten, Molybdenum and Vanadium. By E. S. Boalich and W. O. Castello, 1918. 34 pp. Paper	----
**Preliminary Report No. 5. Antimony, Graphite, Nickel, Potash, Strontium and Tin. By E. S. Boalich and W. O. Castello, 1918. 44 pp. Paper.	----
Preliminary Report No. 6. A Review of Mining in California During 1919. By Fletcher Hamilton, 1920. 43 pp. Paper	Free
**Preliminary Report No. 7. The Clay Industry in California. By E. S. Boalich, W. O. Castello, E. Huguenin, C. A. Logan, and W. B. Tucker, 1920. 102 pp. 24 illustrations. Paper	----
**Preliminary Report No. 8. A Review of Mining in California During 1921, with Notes on the Outlook for 1922. By Fletcher Hamilton, 1922. 68 pp. Paper	----

MISCELLANEOUS PUBLICATIONS

**First Annual Catalogue of the State Museum of California, being the collection made by the State Mining Bureau during the year ending April 16, 1881. 350 pp.	----
**Catalogue of books, maps, lithographs, photographs, etc., in the library of the State Mining Bureau at San Francisco, May 15, 1884. 19 pp.	----
**Catalogue of the State Museum of California, Volume II, being the collection made by the State Mining Bureau from April 16, 1881, to May 5, 1884. 220 pp.	----
**Catalogue of the State Museum of California, Volume III, being the collection made by the State Mining Bureau from May 15, 1884, to March 31, 1887. 195 pp.	----
**Catalogue of the State Museum of California, Volume IV, being the collection made by the State Mining Bureau from March 30, 1887, to August 20, 1890. 261 pp.	----
**Catalogue of the Library of the California State Mining Bureau, September 1, 1892. 149 pp.	----
**Catalogue of West North American and Many Foreign Shells with Their Geographical Ranges, by J. G. Cooper. Printed for the State Mining Bureau, April, 1894	----
**Report of the Board of Trustees for the four years ending September, 1900. 15 pp. Paper.	----
Bulletin. Reconnaissance of the Colorado Desert Mining District. By Stephen Bowers, 1901. 19 pp. 2 illustrations. Paper.	Free
Commercial Mineral Notes. A monthly mimeographed sheet, beginning April, 1923	Free
Leaflet, Mining Law (reprint). 19 pages	Free

MAPS

Register of Mines With Maps.

Asterisks (**) indicate the publication is out of print.

	Price
**Register of Mines, with Map, Amador County	----
**Register of Mines, with Map, Butte County	----
**Register of Mines, with Map, Calaveras County	----
**Register of Mines, with Map, El Dorado County	----
**Register of Mines, with Map, Inyo County	----
**Register of Mines, with Map, Kern County	----
**Register of Mines, with Map, Lake County	----
**Register of Mines, with Map, Mariposa County	----
**Register of Mines, with Map, Nevada County	----
**Register of Mines, with Map, Placer County	----
**Register of Mines, with Map, Plumas County	----
**Register of Mines, with Map, San Bernardino County	----
**Register of Mines, with Map, San Diego County	----
Register of Mines, with Map, Santa Barbara County (1906)	$0.25
**Register of Mines, with Map, Shasta County	----
**Register of Mines, with Map, Sierra County	----
**Register of Mines, with Map, Siskiyou County	----
**Register of Mines, with Map, Trinity County	----
**Register of Mines, with Map, Tuolumne County	----
Register of Mines, with Map, Yuba County (1905)	.25
Register of Oil Wells, with Map, Los Angeles City (1906)	.35

OTHER MAPS

**Map of California, Showing Mineral Deposits (50 x 60 in.)	----
**Map of Forest Reserves in California	----
**Mineral and Relief Map of California	----
**Map of El Dorado County, Showing Boundaries, National Forests	----
**Map of Madera County, Showing Boundaries, National Forests	----
**Map of Placer County, Showing Boundaries, National Forests	----
**Map of Shasta County, Showing Boundaries, National Forests	----
**Map of Sierra County, Showing Boundaries, National Forests	----
**Map of Siskiyou County, Showing Boundaries, National Forests	----
**Map of Tuolumne County, Showing Boundaries, National Forests	----
**Map of Mother Lode Region	----
**Map of Desert Region of Southern California	----
Map of Minaret District, Madera County	20
Map of Copper Deposits in California	.05
**Map of Calaveras County	----
**Map of Plumas County	----
**Map of Trinity County	----
**Map of Tuolumne County	----
Geological Map of Inyo County. Scale 1 inch equals 4 miles	.60
**Map of California accompanying Bulletin No. 89, showing generalized classification of land with regard to oil possibilities. Map only, without Bulletin	----
Geological Map of California, 1916. Scale 1 inch equals 12 miles. As accurate and up-to-date as available data will permit as regards topography and geography. Shows railroads, highways, post offices and other towns. First geological map that has been available since 1892, and shows geology of entire state as no other map does. Geological details lithographed in 23 colors. Unmounted	.75
Mounted	2.00
Topographic Map of Sierra Nevada Gold Belt, showing distribution of auriferous gravels, accompanying Bulletin No. 92 (also sold singly) In 4 colors	.50

OIL FIELD MAPS

(Apply to Division of Oil and Gas.)

DETERMINATION OF MINERAL SAMPLES

Samples (limited to three at one time) of any mineral found in the state may be sent to the Division of Mines and Mining for identification, and the same will be classified free of charge. No samples will be determined if received from points outside the state. It must be understood that no assays, or quantitative determinations will be made. Samples should be in lump form if possible, and marked plainly with name of sender on outside of package, etc. No samples will be received unless delivery charges are prepaid. A letter should accompany sample, giving locality where mineral was found and the nature of the information desired.

INDEX

o

78851 1-31 3M